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NATIONAL DAM SAFETY PROGRAM. KOHL IRRIGATION LAKE SOUTH DAM (MO--ETC(U)
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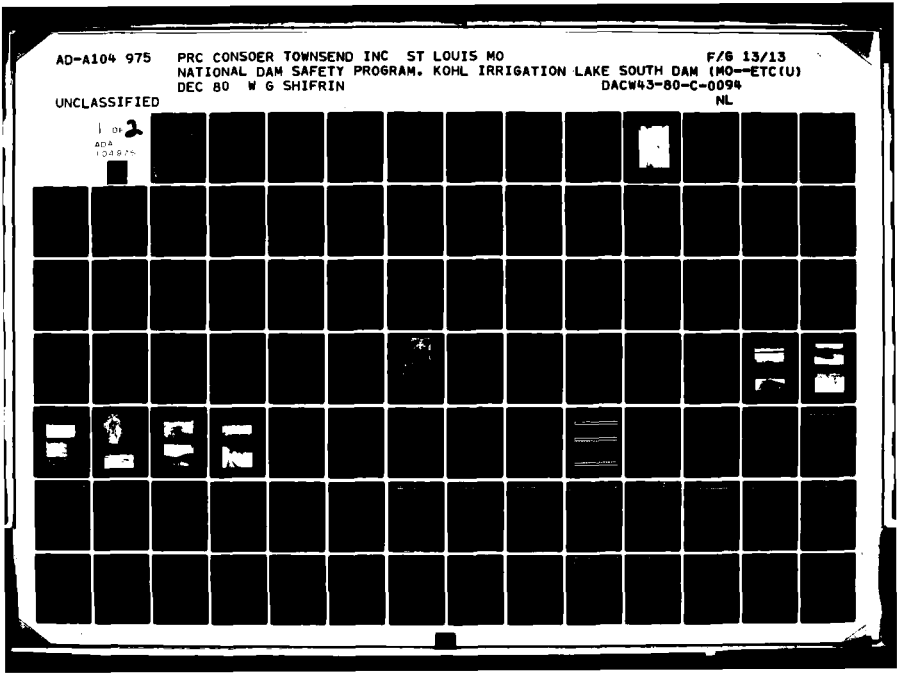

LEVEL II

MISSISSIPPI · SALT · QUINCY RIVER BASIN

KOHL IRRIGATION LAKE SOUTH DAM
AUDRAIN COUNTY, MISSOURI
MO. 11208

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
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St. Louis District

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

DECEMBER 1980

UNCLASSIFIED

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 6310[illegible]

REPLY TO ATTENTION OF

SUBJECT: Kohl Irrigation Lake South Dam (MO 11208) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Kohl Irrigation Lake South Dam (MO 11208).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, emergency by the St. Louis District as a result of the application of the following criteria:

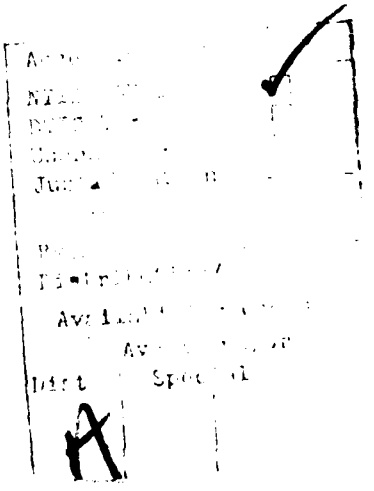
1) The combined capacity of the principal and the emergency spillways will not pass a 10-year frequency flood without overtopping the dam. The spillway capacity is, therefore, considered to be unusually small and seriously inadequate.

2) Overtopping could result in dam failure.

3) Dam failure significantly increases the hazard to life and property downstream

SUBMITTED BY: _____ 12 JAN 1981
Chief, Engineering Division — Date

APPROVED BY: _____ 14 JAN 1981
Colonel, CE, District Engineer — Date



KOHL IRRIGATION LAKE SOUTH DAM
AUDRAIN COUNTY, MISSOURI

MISSOURI INVENTORY NO. 11208

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
CONSOER, TOWNSEND AND ASSOCIATES, LTD.
ST. LOUIS, MISSOURI
AND
PRC ENGINEERING CONSULTANTS, INC.
ENGLEWOOD, COLORADO
A JOINT VENTURE

UNDER DIRECTION OF
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
FOR
GOVERNOR OF MISSOURI

DECEMBER 1980

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Kohl Irrigation Lake South Dam, Missouri Inv. No. 11208
State Located:	Missouri
County Located:	Audrain
Stream:	An unnamed tributary of the Shady Creek
Date of Inspection:	July 9, 1980

Assessment of General Condition

Kohl Irrigation Lake South Dam was inspected by the engineering firms of Consoer, Townsend and Associates, Ltd. of St. Louis, Missouri and PRC Engineering Consultants, Inc. of Englewood, Colorado (A Joint Venture) according to the U. S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District of the Corps of Engineers. Based upon the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. Within the estimated damage zone of one mile downstream of the dam are two houses, one highway, one building, one barn, and a shed which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. Kohl Irrigation Lake South Dam is in the small size classification since it is 14 feet high, and impounds more than 50 acre-feet but less than 1,000 acre-feet of water.

The inspection and evaluation by the consultant's inspection team indicate that the spillway of Kohl Irrigation Lake South Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Kohl Irrigation Lake South Dam being a small size dam with a high hazard potential is required by the guidelines to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping. Considering a major highway being located immediately below the dam and the number of inhabited dwellings located downstream of the dam, the PMF is considered the appropriate spillway design flood for Kohl Irrigation Lake South Dam. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meterorological and hydrologic conditions that are reasonably possible in the region. It was determined that the reservoir/spillway system can accommodate approximately 8 percent of the Probable Maximum Flood without overtopping the dam. The evaluation also indicates that the reservoir/spillway system cannot accommodate the ten-percent chance flood (10-year flood) without overtopping.

There is a significant dam upstream of Kohl Irrigation Lake South Dam. The upstream dam is named as Talbert Lake Dam (MO. 11209). Talbert Lake Dam is located immediately upstream of Kohl Irrigation Lake South and has been included in the hydrologic and hydraulic evaluation of Kohl Irrigation Lake South Dam.

Other deficiencies noted by the inspection team were: the erosion on the upstream slope due to wave action, the tall vegetation on the top of dam and the downstream slope, the separation of the construction joint in the principal spillway, the vegetation at the entrance to the principal spillway, a need for periodic inspection by a qualified engineer, and a lack of maintenance schedule. The lack of seepage and stability analyses on record is also a deficiency that should be corrected.

It is recommended that the owner take action to correct or control the deficiencies described above.

Walter G. Shifrin, P.E.

NATIONAL DAM SAFETY PROGRAM

KOHL IRRIGATION LAKE SOUTH DAM, I.D. No. 11208

TABLE OF CONTENTS

TABLE OF CONTENTS

(Continued)

TABLE OF CONTENTS

(Continued)

LIST OF PLATES

APPENDICES

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

KOHL IRRIGATION LAKE SOUTH DAM, Missouri Inv. No. 11208

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for Kohl Irrigation Lake South Dam was carried out under Contract DACW 43-80-C-0094 between the Department of the Army, St. Louis District, Corps of Engineers, and the engineering firms of Consoer, Townsend & Associates, Ltd., and PRC Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of Kohl Irrigation Lake South Dam was made on July 9, 1980. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project, presents a summary of visual observations made during the field inspection, presents an assessment of hydrologic and hydraulic conditions at the site, and the structural adequacy of the various project features and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing and detailed analyses were not within the scope of this study. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that in this report reference to left or right abutments is viewed as looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to the north abutment or side, and right to the south abutment or side.

d. Evaluation Criteria

The inspection and evaluation of the dam is performed in accordance with the U.S. Army Corps of Engineers "Recommended Guidelines for Safety Inspection of Dams" and additional guidelines furnished by the St. Louis District office of the Corps of Engineers for Phase 1 Dam Inspection.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based on the observations and measurements made during the visual inspection and conversations with Mr. Fred Kohl, the owner. Original design drawings for the dam and appurtenant structures were available; however, the dam and

appurtenant structures were not constructed in accordance with these drawings. No final design drawings or "as-built" drawings were available.

According to Mr. Kohl, the dam is a zoned, rolled, earthfill structure with a straight alignment between earth abutments. A plan and elevation of the dam are shown on Plate 2 and Photos 1 through 3 show views of the embankment. According to Mr. Kohl, a 12-foot wide clay core trench with nearly vertical side slopes was excavated to a maximum depth of 10 feet into a gray and red mottled clay foundation soil. The core, which was constructed of a select clay soil, extends all the way up through the embankment. The upstream and downstream shells were constructed of a lesser quality clay material.

The top of the dam is 16 feet wide and appeared to be level except the area near the principal spillway. The crest length of the dam, excluding the centrally located, concrete-lined spillway, is 732 feet. A 3- to 4-foot high training berm for the emergency spillway extends for 115 feet at a right angle off the left end of the embankment in the upstream direction. The major portion of the dam has a crest elevation of 763 feet above mean sea level (M.S.L.). The minimum top of dam elevation, however, was placed at 761 feet above M.S.L. for hydraulic evaluation due to the fact that the dam embankment at the principal spillway is unprotected at this elevation (see Plate 2). Thus, this is considered to be the point at which the dam embankment would be overtopped. The maximum structural height of the embankment was measured to be 14 feet at a point 10 feet to the left of the principal spillway.

The upstream slope above the water surface and the downstream slope of the dam were measured as 1 vertical to 2.75 horizontal (1V to 2.75H), though some difficulty was encountered in obtaining these measurements. Tall grasses obstructed accurate slope measurements in the downstream direction, and wave-eroded slopes and a near horizontal berm at the water's edge hampered

measurements on the upstream slope. However, it is assumed that measurements obtained are representative. No riprap was placed on the upstream slope. The entire embankment is protected by vegetative cover.

A principal and an emergency spillway were constructed for this dam. The principal spillway is a concrete-lined, trapezoidal-shaped, chute spillway cut into the embankment 328 feet to the left of the right abutment (see Photos 5 and 6). The first 26 feet of the channel has a bottom width of 12 feet with side slopes of 1V to 1.75H and is level (see Plate 3). The channel, at the end of the 26-foot long section, has a transition within a 30-foot length in which the bottom width tapers from 12 feet to 8 feet, the side slopes flatten out to 1V to 3H, and the channel slopes downward on a 42 percent grade. The channel then begins to flatten out from about a 32 percent grade to an 18 percent grade before entering a 5-foot high by 8-foot wide concrete box culvert that passes under Highway W, located approximately 50 feet downstream of the dam. The crest elevation of the spillway is assumed to be at 759 feet above M.S.L. A 2-foot high metal trashrack was provided for the spillway and is located at the entrance to the spillway (see Photo 11). According to Mr. Kohl, the concrete of the spillway is reinforced.

The emergency spillway is a grass-lined, trapezoidal, open channel cut into the left abutment. The spillway has a bottom width of 23 feet, a top width of 50 feet with side slopes of about 1V to 4.5H, and is located about 115 feet upstream of the embankment (see Plate 2). The flows through the spillway are directed by a 115-foot long training berm back towards the embankment. The flows, once past the embankment, will flow through a natural channel created by the dam and highway embankments and in the direction of the box culvert under the highway. The crest elevation of the spillway is 760 feet above M.S.L., assuming the crest of the principal spillway is at 759 feet above M.S.L. The spillway channel has a slope of about a half of a percent for a distance of about 200 feet at which point the channel steepens.

No low-level outlets or outlet works were provided for this dam. However, a portable, diesel-powered, centrifugal pump is used at the damsite to pump water from the reservoir to be used to irrigate row crops on the reservoir rim. According to Mr. Kohl, the pump has an 1,000 gallons per minute (gpm) capacity and the capability to drain the reservoir. The pump is also, reportedly, operable; however, on the day of the inspection, the pump was not at the damsite. The pump is generally operated each year during the summer months.

b. Location

Kohl Irrigation Lake South Dam is located in Audrain County in the State of Missouri, and crosses an unnamed tributary of Shady Creek. The small community of Vandalia is about 1-1/2 miles to the north. The Kohl Irrigation Lake South Dam location on the 7.5 minute series of the U.S. Geological Survey maps is found in Section 17 of Township 52 North, Range 5 West, of the Vandalia, Missouri Quadrangle Sheet.

c. Size Classification

The impoundment of Kohl Irrigation Lake South Dam is less than 1,000 acre-feet but more than 50 acre-feet, and the height is 14 feet. Therefore, the size is determined to fall in the "small" category, according to the "Recommended Guidelines for Safety Inspection of Dams" by the U.S. Department of the Army, Office of the Chief Engineer.

d. Hazard Classification

The dam has been classified as having a "high" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with this classifi-

cation. Within the estimated damage zone, extending one mile downstream of the dam, are two houses, one highway immediately below the dam, one building, one barn and a shed.

e. Ownership

Kohl Irrigation Lake South Dam and Reservoir is privately owned by Mr. Fred Kohl. His mailing address is as follows: Route 1, Vandalia, Missouri, 63302.

f. Purpose of Dam

As the name of the dam implies, the water impounded by the dam is used for crop irrigation.

g. Design and Construction History

Kohl Irrigation Lake South Dam was designed by the Department of Agriculture, Soil Conservation Service, in the Mexico, Missouri Office. According to Mr. Kohl, the design drawings were not completely followed during the construction of the dam. Mr. Kohl also stated that he had the height of the dam increased by about one foot in 1975. The original construction was done by Mr. Paul Goodman of Vandalia, Missouri, in 1973.

h. Normal Operational Procedures

Normal operational procedure is to allow the reservoir to remain as full as possible while the water level below the principal spillway crest is controlled by rainfall, runoff, evaporation, and the rate at which water is pumped out of the reservoir for agricultural use.

1.3 Pertinent Data

a. Drainage Area (square miles):. 0.64

b. Discharge at Damsite

Estimated experienced maximum flood (cfs): 10

Estimated ungated spillway capacity with reservoir at top of dam elevation (cfs): 198

c. Elevation (Feet above M.S.L.)

Top of dam (minimum):. 761

Spillway crest:

Principal Spillway * * 759

Emergency Spillway 760

Normal Pool: 759

Maximum Experienced Pool:. 760.7

Observed Pool: 754.3

d. Reservoir

Length of pool with water surface at top of dam elevation (feet):. 930

e. Storage (Acre-Feet)

Top of dam (minimum):. 111

Spillway crest:

Principal Spillway 75

Emergency Spillway 91

Normal Pool: 75

Maximum Experienced Pool:. 104

Observed Pool: 25

f. Reservoir Surfaces (Acres)

Top of dam (minimum):. 21.1

Spillway crest:

Principal Spillway 15.4

Emergency Spillway	18.2
Normal Pool:	15.4
Maximum Experienced Pool:.	20.2
Observed Pool:	7.5

g. *Dam*

Type:.	Rolled, Earthfill
Length:.	732 feet (excluding the principal spillway)
Structural Height:	14 feet
Hydraulic Height:.	14 feet*
Top width:	16 feet
Side slopes:	
Downstream.	1V to 2.75H
Upstream.	1V to 2.75H (Above the water surface)
Zoning:.	Three zones, (1) Impervious select clay core, (2) Upstream and (3) downstream shells of poorer clay.(According to Mr. Kohl)
Impervious core:	Clay core
Cutoff:.	A 12-foot wide and 10-foot deep core trench (According to Mr. Kohl)
Grout curtain:	None
Volume:.	16,000 cu. yds. (Estimated)

h. Diversion and Regulating Tunnel. . . . . None

i. Spillway

Type:	
Principal Spillway	Concrete chute channel, uncontrolled
Emergency Spillway	Earthcut channel, uncontrolled

Length of crest:

Principal Spillway	12 feet
Emergency Spillway	23 feet

Crest Elevation (feet above M.S.L.):

Principal Spillway	759
Emergency Spillway	760

j. Regulating Outlets

Type:	Portable, centrifugal pump
Location:	Northwest corner of reservoir. (However, the pump was not at the dam site on the day of the inspection)
Maximum Capacity:	1,000 gallons per minute (According to Mr. Kohl)

* The hydraulic height of the dam is the vertical distance from the lowest point on the downstream toe to the top of dam or the maximum water surface, if below the top of dam.

** The elevation of the crest of the principal spillway was assumed from the U.S.G.S. topo map, and the elevations of other features of the dam were determined using this elevation and field measurements.

SECTION 2: ENGINEERING DATA

2.1 Design

Original design sketches and calculations were made available from the Soil Conservation Service and the owner, Mr. Fred Kohl. The design notes from the SCS are dated July of 1972; however, as mentioned before, the original design was not used. Final design drawings or "as-built" drawings were not available.

2.2 Construction

No documented data concerning the construction of the dam was available for this report. However, information concerning the construction of the dam was obtained through conversations with Mr. Kohl. Mr. Kohl stated that the compaction of the embankment was achieved by the activity of the earthmoving equipment across the embankment. No compaction control of the material was employed. A 12-foot wide and 10-foot deep core trench with vertical side slopes was excavated parallel to the dam axis and into the clay foundation.

2.3 Operation

No operational records are available for Kohl Irrigation Lake South Dam.

2.4 Evaluation

a. Availability

The availability of engineering data is fair and consists of the original design sketches, engineering computations, State Geological Maps, a general soil map of the State of Missouri published by the Soil Conservation Service, and U.S.G.S. Quadrangle Sheets.

b. Adequacy

The conclusions presented in this report are based on field measurements, the available engineering data, past performance and present condition of the dam. The available data and the field measurements are adequate enough to evaluate the hydraulic and hydrologic capabilities of the dam. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Validity

Original design sketches and computations were available for review. However, the original design sketches were not used during the construction. Final design drawings were not available for review. The only engineering data which were felt to be valid were the area-capacity data for the reservoir and are presented in this report in Appendix B.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Kohl Irrigation Lake South Dam was made on July 9, 1980. The following persons were present during the inspection:

Name	Affiliation	Disciplines
Dr. M.A. Samad	PRC Engineering Consultants, Inc.	Project Engineer, Hydraulics and Hydrology
Mark Haynes, P.E.	PRC Engineering Consultants, Inc.	Civil and Mechanical
Razi Quraishi, R.P.G.	PRC Engineering Consultants, Inc.	Geology
Zoran Batchko	PRC Engineering Consultants, Inc.	Soils
Kevin J. Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural
Fred Kohl	Owner	

Specific observations are discussed below.

b. Dam

The crest and the downstream slope of the dam have a tall, dense grass cover, which adequately protects the embankment material from surface runoff erosion. However, the upstream slope has a sparse vegetative cover, and surface runoff has eroded small drainage rivulets on the order of 1 to 3 inches on the upstream face. The upstream slope also has no riprap protection and, consequently, has been eroded by wave action. Nearly vertical faces up to 2 feet high were exposed near the crest of the dam and smaller scallops were also exposed along the reservoir rim. The dam material underlying the grayish-brown topsoil cover was revealed to be a mottled red, brown, and gray, moderately plastic clay with some silt and sand.

There was no evidence of seepage or leakage through or below the dam. No signs of past or present instability were seen on the embankment except for the wave eroded upstream slope. According to Mr. Kohl, the dam has never been overtopped and no evidence indicating the contrary was observed.

Both abutments slope gently upward from the top of dam. No instabilities, seepage, or erosion were observed on either abutment.

No evidence of burrowing animals was apparent on either the embankment or abutments. According to Mr. Kohl, muskrats have been present in the reservoir in the past.

c. Project Geology and Soils

(1) Project Geology

The damsite is located on an unnamed tributary of Shady Creek in the Dissected Till Plains Section of the central Lowland Physiographic Province. Loess-mantled Kansas drift covers the surface of most of the Dissected Till Plains Section. This section is distinguished from the Young Drift Section to the north and from the Till Plains on the east by the stage it has reached in the post-glacial erosion cycle. Broadly generalized, this section is a nearly flat till plain submature to mature in its erosion cycle.

The topography at the damsite is flat to rolling with U-shaped valleys. Elevations of the ground surface range from 750 feet above M.S.L. at the damsite to 780 feet above M.S.L. approximately one mile south of the damsite. The reservoir slopes are in the range of 8^{o} to 12^{o} from the horizontal and free of any potential slide activity. The area near the damsite is covered with slope wash deposits of glacial-fluvial and loess in origin consisting of mottled reddish brown to gray silty clay.

The regional bedrock geology beneath the glacial outwash deposits in the damsite area as shown on Geologic Map of Missouri (1977) (see Plate 4) consist of Pennsylvanian Pleasanton-Marmaton-Cherokee Group, Mississippian Burlington Formation and Chouteau Group rocks, Silurian Bowling Green Limestone, and Ordovician rocks consisting of Noix Limestone and Decorah Formation.

No outcropping of bedrock was observed at the site. The predominant bedrock in the site vicinity underlying the glacial-fluvial deposits are the Pennsylvanian Marmaton-Cherokee Group consisting of cyclic deposits of shale, limestone and sandstone. The outlet and inlet areas of the unnamed tributary of the Shady Creek contain Quaternary alluvium.

No faults have been identified in the vicinity of the damsite. The closest trace of a fault to the damsite is the Cap Au Gres faulted flexure nearly 12 miles east of the damsite. The Cap Au Gres faulted flexure had its last movement in post-Pennsylvanian, pre-Pleistocene time. Thus the fault has no effect on the damsite.

Kohl Irrigation Lake South Dam consists of a zoned earthfill embankment, a concrete lined principal spillway located at approximately the mid-point of the embankment, and an emergency spillway located at the northern end of the dam.

No boring logs or construction reports were available which would indicate foundation conditions encountered during the construction. Based upon the visual inspection and conversations with Mr. Fred Kohl, the embankment probably rests on the glacial-fluvial deposits (mottled reddish brown to gray silty clay) with a core trench excavated into the glacial-fluvial deposits. The concrete lined principal spillway rests on the compacted embankment fill (mottled reddish brown to gray, medium plastic clay). The emergency spillway was cut into the left abutment.

(2) Project Soils

According to the "Missouri General Soil Map and Soil Association Descriptions" published by the Soil Conservation Service, the materials in the general area of the dam belong to the soil series of Putnam-Mexico in the Central-Claypan area family. The soils are basically formed from loess. These soils are mostly a very slowly permeable silty clay.

Materials were removed from both slopes of the embankment from below the vegetative cover. The embankment soils samples obtained were observed to be mottled red, brown, and gray, moderately plastic clay with some silt and sand. Based upon the Unified Soil Classification system, the soil would probably be classified as CL-CH. This soil type generally has the following character-

istics: impervious with a coefficient of permeability less than 1.0 foot per year, medium shear strength, and a high resistance to piping.

d. Appurtenant Structures

(1) Principal Spillway

No major problems were observed in the spillway. No major cracks were found in the concrete; however, some minor shrinkage cracks were observed. The construction joint between the slab and the side wall on the left side of the spillway and only along the upper portion of the channel was observed to be up to 1/2 of an inch wide with no joint filler present (see Photo 7). The separation of the joint extended the full thickness of the slab. However, separation of the joint between the slab and the side walls in the rest of the spillway channel was apparent. No undermining of the spillway was apparent. The trashrack was securely attached to the spillway and appeared to be able to function as intended. Some vegetation was observed growing around the entrance to the spillway. No instabilities or obstructions were observed in the spillway and the spillway appears to be able to function properly.

(2) Emergency Spillway

The spillway has, for the most part, a good vegetative cover; however, some areas near the inlet section of the spillway were sparsely covered. It is felt, however, due to the location in the channel of these areas, erosion of the channel in these areas would have little or no effect on the safety of the dam or the operation of the spillway. No erosion or instabilities were observed in the spillway channel. The spillway was unobstructed and appeared to be able to operate properly.

(3) Outlet Works

There are no low level outlets or outlet works provided for this dam. However, a portable, centrifugal pump is used at the damsite. Reportedly, the pump is operable and is also capable of draining the reservoir. The pump is generally used during the summer months each year.

(4) Upstream Dam

There is a significant dam upstream of Kohl Irrigation Lake South Dam. The upstream dam is identified as Talbert Lake Dam (MO. 11209). This dam is located immediately upstream of Kohl Irrigation Lake South and is included in the hydrologic and hydraulic evaluation of Kohl Irrigation Lake South Dam.

e. Reservoir Area

The reservoir water surface elevation at the time of inspection was 754.3 feet above M.S.L.

The surface area of the reservoir at normal water level is about 15.4 acres. The rim seems to be stable as no severely eroded areas were observed. The land around the reservoir slopes gently to the rim and is grass covered. There are no homes built in close proximity to the reservoir; however, there is a dam located at the upper end of this reservoir (see Photo 11), and a 2- to 4-foot high perimeter dike extending along the left side of the reservoir. With the exception of small, localized, undercut slopes in the perimeter dike, there was no evidence of instability. No evidence of excessive siltation was observed in the reservoir.

f. Downstream Channel

The flows from the principal and the emergency spillway will converge at the culvert which passes under Highway W, which is located approximately 50 feet downstream of the dam. The downstream channel beyond the culvert is a well defined channel, which is

approximately 5 feet wide, 3 feet deep and has variable side slopes. The channel is obstructed by heavy vegetation and trees, which will affect the hydraulic efficiency of the channel (see Photo 10).

3.2 Evaluation

The visual inspection did not reveal any items that are sufficiently significant to indicate a need for immediate remedial action. The following problems were observed that could affect the safety of the dam and which will require maintenance within a reasonable period of time.

1. The erosion due to wave action and minor surface runoff erosion on the upstream slope do not appear to affect the structural stability of the dam in their present condition. Continual erosion, however, of the slope can only be detrimental to the stability of the dam.

2. The growth of vegetation on the top of dam and downstream slope should be properly maintained. A tall, dense growth of vegetation on the embankment hinders a comprehensive inspection of the dam and potential problems could go undetected.

3. The separation of the construction joint does not appear to affect the stability of the principal spillway in its present condition nor does it indicate an instability of the spillway. Nevertheless, if the condition is left unchecked, water can be forced down through the joint and under the slab during flows through the spillway. This could cause undermining of the spillway slab, which could lead to an eventual failure of the slab.

4. The vegetative growth at the entrance to the principal spillway does not appear to restrict the hydraulic capabilities of the spillway in its present condition. Nevertheless, the condition does exist and if the vegetation is allowed to continue to grow, it could affect the hydraulic capacity of the spillway.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Kohl Irrigation Lake South Dam is used to impound water from rainfall and runoff for crop irrigation. There are no specific procedures which are followed for the operation of the reservoir. The water level in the reservoir is controlled by rainfall, runoff, evaporation, the elevation of the crest of the principal spillway, and irrigation usage of the reservoir.

4.2 Maintenance of Dam

The dam is maintained by the owner, Mr. Fred Kohl. The grass on the slopes and the dam crest is mowed periodically. Mr. Kohl mentioned that in 1974 he stopped the erosion near the water surface on the upstream slope by adding soil in several places. The owner also periodically checks for seepage and rodent activity.

4.3 Maintenance of Operating Facilities

There are no operating facilities at the damsite which require maintenance except for the portable centrifugal pump. On the day of the inspection, the pump was not at the damsite.

4.4 Description of Any Warning System in Effect

The inspection team is not aware of any warning system in use at the damsite.

4.5 Evaluation

The maintenance at Kohl Irrigation Lake South Dam appears to be adequate, however, the remedial measures described in Section 7 should be undertaken to improve the condition of the dam.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

No hydrologic and hydraulic design data, except a computation sheet showing elevation-area-capacity data supplied by the owner, is available for Kohl Irrigation Lake South Dam and the upstream dam. The sizes of physical features utilized to develop the stage-outflow relation for the spillway and overtopping of the dams were prepared from field notes and sketches prepared during the field inspection. The reservoir elevation-capacity data were based on the computation sheet supplied by the owner and the U.S.G.S. Vandalia, Missouri Quadrangle topographic map (7.5 minute series). The spillway and overtop release rates and the reservoir elevation capacity data are presented in Appendix B.

The hydrologic soil groups of the two watersheds, one above the upstream dam and the other between the upstream dam and Kohl Irrigation Lake South Dam were determined from information available in the U.S.D.A. Soil Conservation Service publication "Missouri General Soil Map and Soil Association Descriptions", 1979. The Probable Maximum Precipitation (PMP) used to determine the Probable Maximum Flood (PMF) was determined by using the U.S. Weather Bureau publication, "Hydrometeorological Report No. 33" (April, 1956).

b. Experience Data

It is believed that records of reservoir stage or spillway discharge are not maintained for this site. However, according to Mr. Fred Kohl, the maximum reservoir level was about 20 inches above the crest of the principal spillway.

c. Visual Observations

Observations made of the spillways during the visual inspection are discussed in Section 3.1d.(1) and (2) and evaluated in Section 3.2.

d. Overtopping Potential

Both the Probable Maximum Flood, and one-half of the Probable Maximum Flood when routed through the reservoir, resulted in overtopping of the dam. The peak inflows for the PMF and one-half of the PMF are 4372 cfs and 1933 cfs respectively. The peak outflow discharges for the PMF and one-half of the PMF are 4,247 and 1,518 cfs, respectively. The combined maximum capacity of the spillways just before overtopping the dam is 198 cfs. The PMF overtopped the dam by 3.02 feet and one-half of the PMF overtopped the dam by 2.28 feet. The total duration of overflow over the top of dam is 13.58 hours during the PMF and 9 hours during one-half of the PMF. The spillway/reservoir system of Kohl Irrigation Lake South Dam is capable of accommodating a flood equal to approximately 8 percent of the PMF just before overtopping the dam. The reservoir/spillway system of Kohl Irrigation Lake South Dam will not accommodate the ten-percent chance flood without overtopping the dam. The Talbert Lake Dam (MO. 11209) mentioned in Section 3.1d has been included in determining the overtopping potential of Kohl Irrigation Lake South Dam. The Kohl Irrigation Lake South Dam may be susceptible to erosion due to high velocity flow on its downstream slope, due to overtopping of the dam. The emergency spillway will not probably be subject to excessive erosion because it has a good cover of grass.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. The estimated damage zone extends approximately one mile downstream of the dam. Within the damage zone are one highway approximately 50 feet downstream of the dam, two houses, one building, one barn and a shed.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement observed on the embankment or foundation during the visual inspection. There were no signs of distress on the embankment other than the erosion due to wave action on the upstream face. The upstream slope does not have a protective riprap layer and, consequently, has undergone erosion. The top of dam and downstream slope are protected by a vegetative cover. In the absence of seepage and stability analyses, no quantitative evaluation of the structural stability can be made. The spillways appeared to be structurally stable on the day of the inspection.

b. Design and Construction Data

Design computations pertaining to the embankment were not available during the report preparation phase. Seepage and stability analyses comparable to the requirements of the "Recommended Guidleines for Safety Inspection of Dams" were not available. No embankment or foundation soil parameters were available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction were available for use in a stability analysis.

c. Operating Records

No operating records were available relating to the dam or appurtenant structures. The water level on the day of the visual inspection was 4 feet 8 inches below the crest of the principal spillway. The water level in the reservoir has apparently been 20 inches above the crest of the principal spillway at its highest point in recent years, according to Mr. Kohl. The reservoir surface elevation is normally controlled by the crest of the principal spillway.

d. Post Construction Changes

It is unknown what affect the changes in the original design had on the stability of the dam, if any. However, the only modification, which has been completed since the dam was constructed, was the addition of one foot of soil to the crest to level off the dam approximately one year after completion of the embankment. This did not appear to affect the structural stability of the dam; however, this could have a positive effect on the safety of the dam.

e. Seismic Stability

The dam is located in Seismic Zone 1, as defined in "Recommended Guidelines for Safety Inspection of Dams" prepared by the Corps of Engineers, and will not require a seismic stability analysis. An earthquake of the magnitude which would be expected in Seismic Zone 1 will not cause distress to a well designed and constructed earth dam. Available literature indicates no active faults exist near the vicinity of the damsite.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigations, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based upon observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends upon numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be assurance that an unsafe condition could be detected.

a. Safety

The spillway capacity of Kohl Irrigation Lake South Dam is found to be "Seriously Inadequate". The spillway/reservoir system will accommodate approximately 8 percent of the PMF without overtopping the dam. The surface soils in the embankment and the emergency spillway appears to be clay with some silt and sand. The emergency spillway has a good cover of grass and the embankment supports a dense growth of tall vegetation. The dam is overtopped by over 3 feet during the occurrence of the PMF. The maximum velocity of flow in the emergency spillway during PMF will be about

6 ft/sec. The emergency spillway channel will probably not be subject to excessive erosion at this velocity of flow during the PMF. However, the dam may be susceptible to erosion due to high velocity of flow on its downstream slope, due to overtopping of the dam during the PMF.

A quantitative evaluation of the safety of the embankment could not be made in view of the absence of seepage and stability analyses. The dam, however, appears to be in generally good condition except for the erosion due to wave action observed on the upstream face. The present embankment and appurtenant structures, however, according to Mr. Kohl, have performed satisfactorily since their construction; there have been no failures or evidence of instability. According to Mr. Kohl, the dam has never been overtopped and no evidence indicating the contrary was observed. The safety of the dam can be improved if the deficiencies described in Section 3.2 and 6.1a are properly corrected as described in Section 7.2.

b. Adequacy of Information

The conclusions presented in this report are based upon field measurement, past performance and the present condition of the dam. Some information on the design hydrology and hydraulic design of the dam was available; however, the dam was not built according to the original design. For example, the design calls for a drop inlet spillway, but a chute type spillway has been provided instead. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency

The remedial measures recommended in Paragraph 7.2 should be accomplished within a reasonable period of time, and the item recommended in paragraph 7.2a should be pursued on a high priority basis.

d. Necessity for Phase II Inspection

Based upon results of the Phase I inspection, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

a. Alternatives

One of the following mitigation measures should be undertaken to avoid severe consequences of dam failure from overtopping.

1. Increase the capacity of the spillways to pass the Probable Maximum Flood without overtopping the dam.

2. Increase the height of the dam enough to pass the PMF without overtopping the dam; an investigation also should be done that includes studying the effects on the structural stability of the existing embankment. The overtopping depth during the occurrence of the PMF, stated in Section 5.1d, is not the required or recommended increase in the height of the dam.

3. A combination of 1 and 2 above.

b. O & M Procedures

1. The erosion on the upstream slope due to wave action and surface runoff should be properly repaired and the upstream slope adequately protected against future erosion due to wave action and surface runoff.

2. The vegetation on the embankment, especially the vegetation on the top of dam and the downstream slope, should be properly maintained and an adequate vegetative cover retained on the embankment to protect it from surface erosion. Large vegetation, such as bushes and trees, should be prevented from growing on the embankment.

3. The separation of the construction joint in the principal spillway should be properly repaired.

4. The vegetation at the entrance to the principal spillway should be removed and further growth of vegetation in the spillway prevented.

5. Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of earth dams.

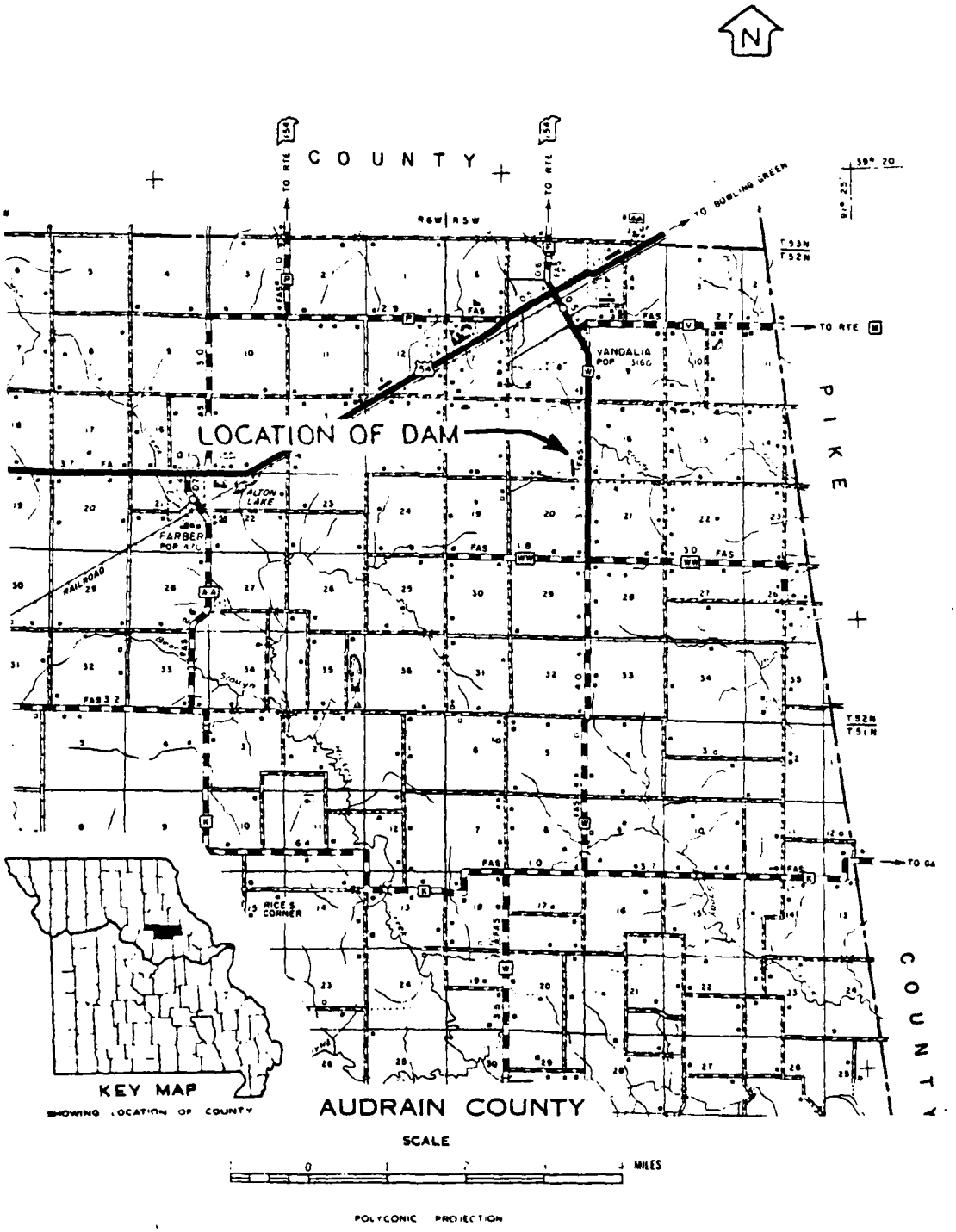
6. The owner should initiate the following programs:

   (a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earth dams.

   (b) Set up a maintenance schedule and log all visits to the dam for operation, repairs, and maintenance.

PLATES

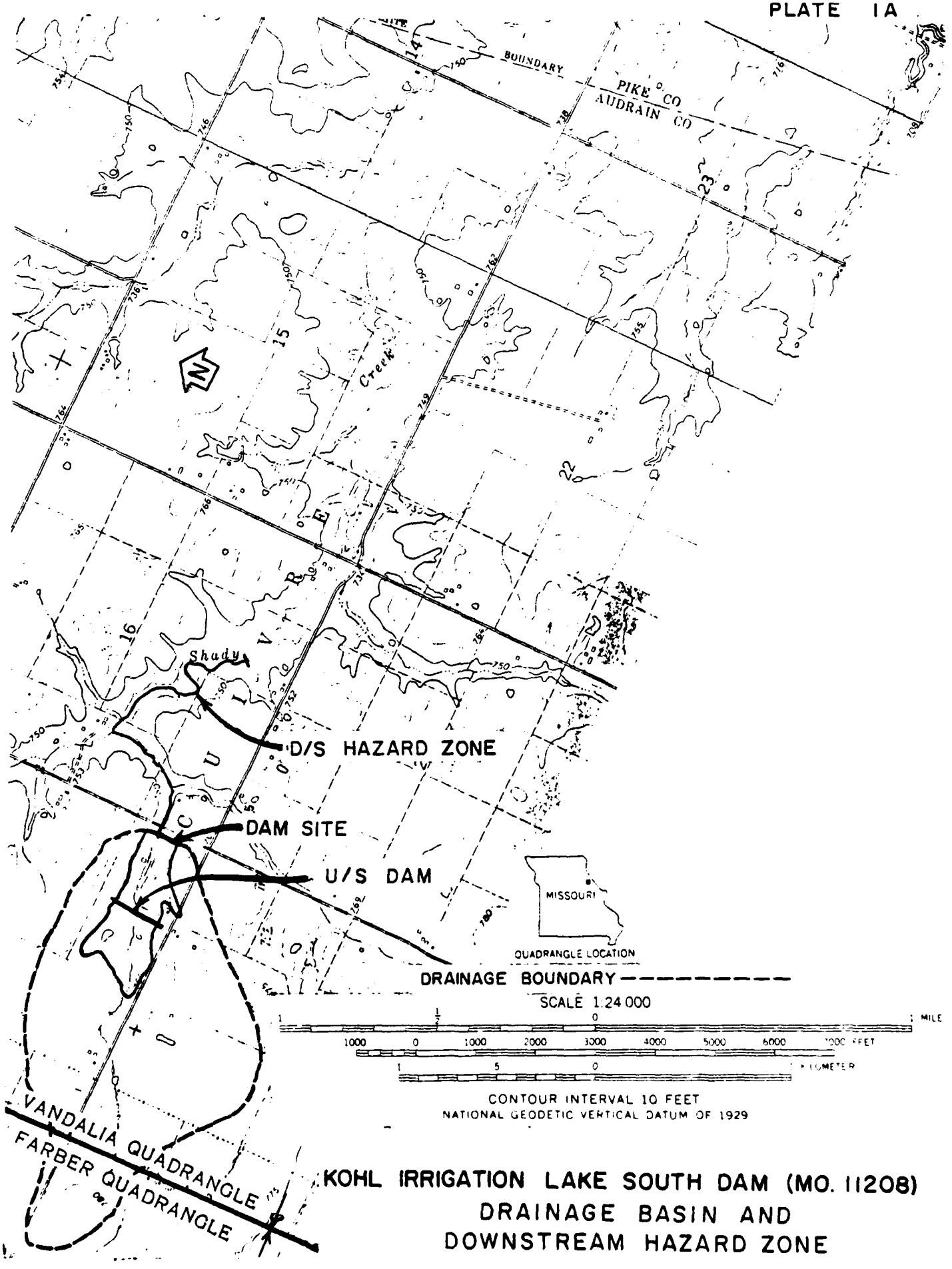
PLATE 1



LOCATION MAP - KOHL IRRIGATION LAKE SOUTH DAM

MO.-11208

PLATE 1A



KOHL IRRIGATION LAKE SOUTH DAM (MO. 11208)
DRAINAGE BASIN AND DOWNSTREAM HAZARD ZONE

KOHL IRRIGATION LAKE SOUTH DAM (MO. 11208)
PLAN & ELEVATION

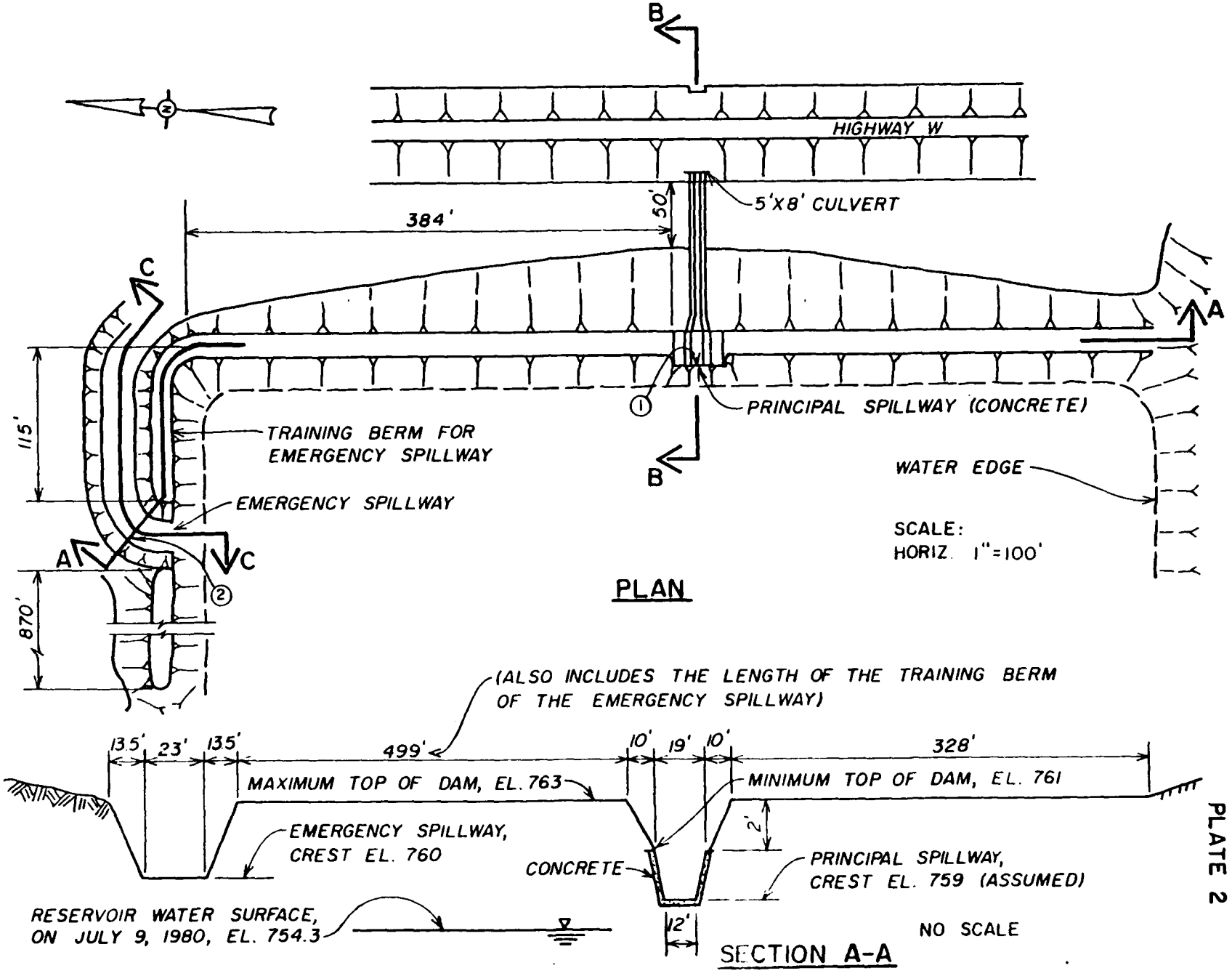
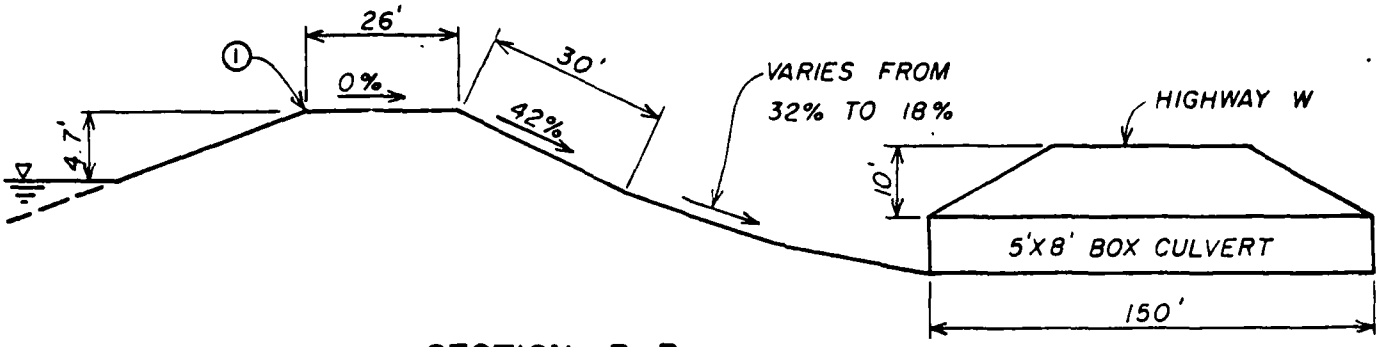
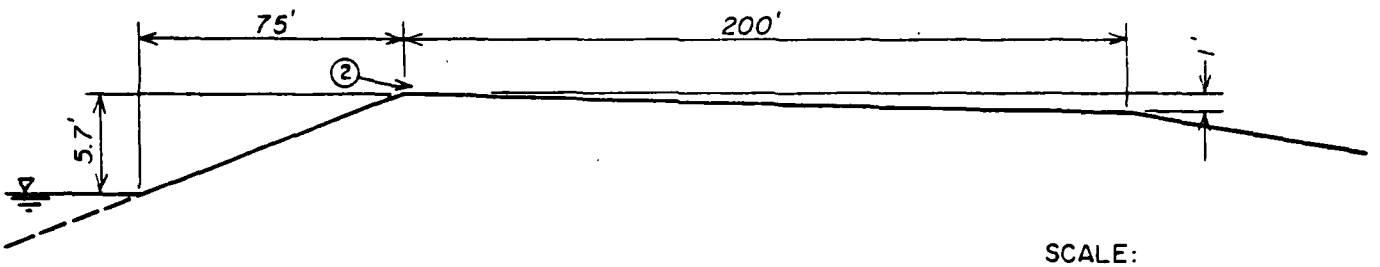


PLATE 2



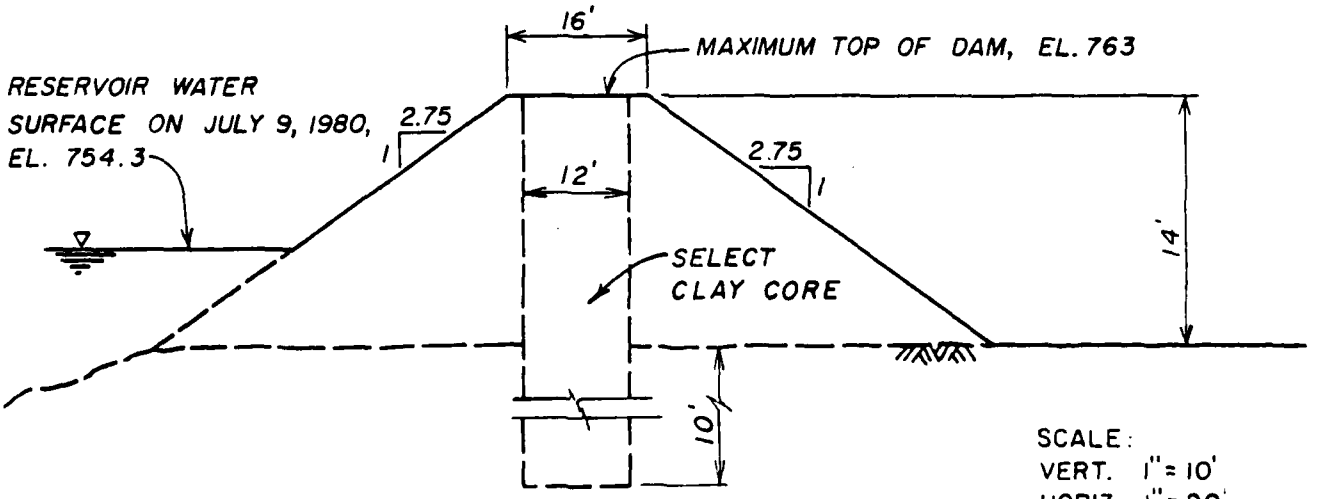
SECTION B-B
PRINCIPAL SPILLWAY PROFILE

NO SCALE



SECTION C-C
EMERGENCY SPILLWAY PROFILE

SCALE:
VERT. 1"=10'
HORIZ. 1"=50'

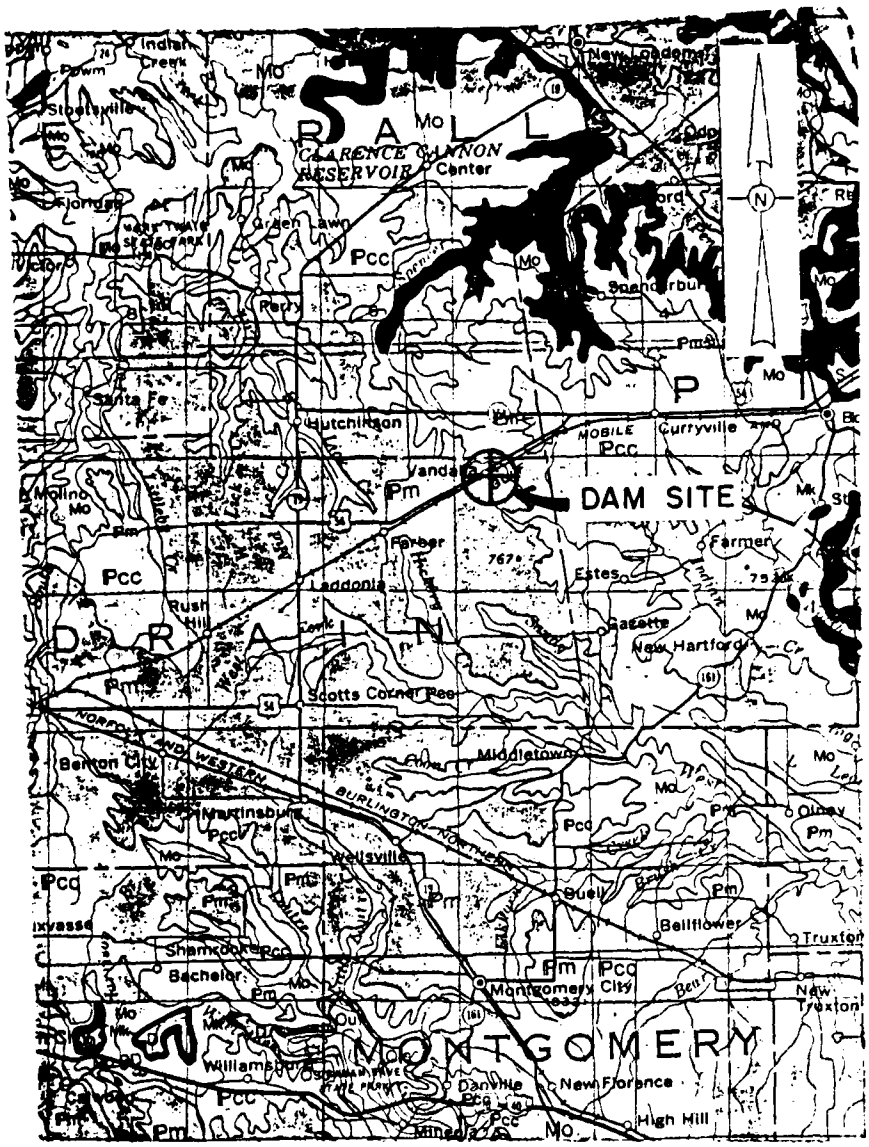


MAXIMUM SECTION

SCALE:
VERT. 1"=10'
HORIZ. 1"=20'

KOHL IRRIGATION LAKE SOUTH DAM (MO. 11208)
PROFILES
PRINCIPAL & EMERGENCY SPILLWAYS,
MAXIMUM SECTION

PLATE 4



SCALE

10 0 10 20 30 40 Miles

⊕ LOCATION OF DAM

NOTE: LEGEND OF THIS DAM IS ON PLATE 5

REFERENCE:

GEOLOGIC MAP OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES
MISSOURI GEOLOGICAL SURVEY
KENNETH H. ANDERSON, 1979

REGIONAL GEOLOGICAL MAP
OF
KOHL IRRIGATION LAKE S DAM

KOHL IRRIGATION
LAKE SOUTH DAM -

PLATE 5

LEGEND

PERIOD	SYMBOL	DESCRIPTION
QUATERNARY	Qal	ALLUVIUM: SAND, SILT, GRAVEL
PENNSYLVANIAN	PPwm	PLEASANTON GROUP: CYCLIC DEPOSITS OF SANDSTONE SHALE AND LIMESTONE
	Pm	MARMATON GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
	Pcc	CHEROKEE GROUP: CYCLIC DEPOSITS OF SHALE, LIMESTONE AND SANDSTONE
MISSISSIPPIAN	Mo	KEOKUK - BURLINGTON FORMATION: CHERTY GRAYISH BROWN SANDY LIMESTONE
	Mk	CHOUTEAU GROUP: HANNIBAL AND BACHELOR FORMATION (SANDSTONE, SHALE, CHERTY LIMESTONE, DOLOMITE)
SILURIAN	S	BOWLING GREEN LIMESTONE
ORDOVICIAN	Ou	NOIX LIMESTONE
	Odp	DECORAH FORMATION: GREEN TO GRAY CALCAREOUS SHALE WITH THIN FOSSILIFEROUS LIMESTONE

APPENDIX A

PHOTOGRAPHS

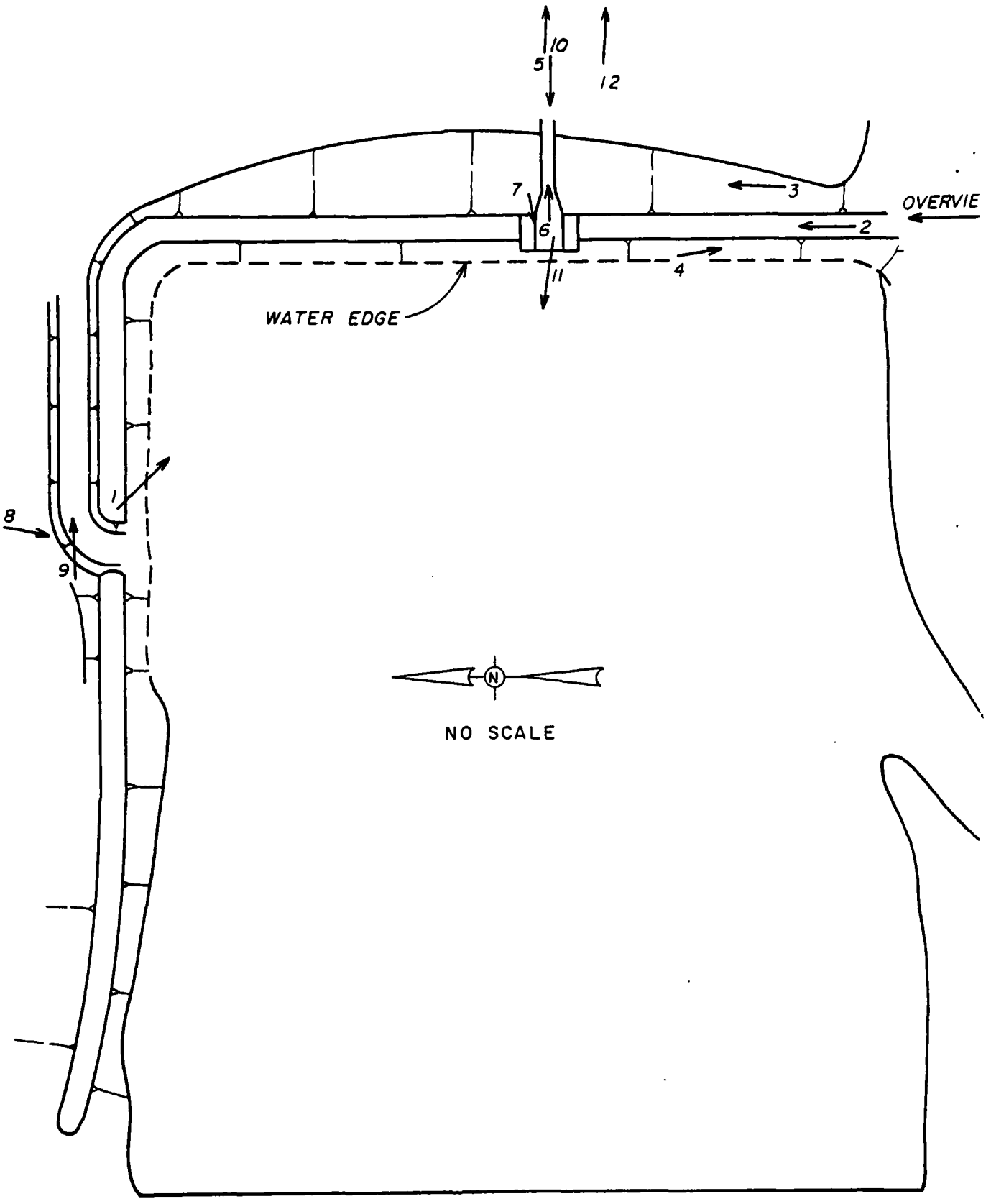


PHOTO INDEX
FOR
KOHL IRRIGATION LAKE
SOUTH DAM

Kohl Irrigation Lake South Dam

Photographs

Photo 1 - Overview of the upstream slope showing vegetative cover and location of the principal spillway.

Photo 2 - View of the top of dam showing the dense vegetative cover.

Photo 3 - View of the downstream slope showing the dense vegetative cover.

Photo 4 - View of the scarp due to wave erosion on the upstream slope.

Photo 5 - View of the principal spillway from Highway W looking back toward the reservoir.

Photo 6 - View of the principal spillway discharge channel and box culvert that passes under Highway W.

Photo 7 - Close-up view of the separation of the joint between the slab and side walls of the principal spillway.

Photo 8 - View of the emergency spillway.

Photo 9 - View of the emergency spillway channel with the training berm on the right side of the photo.

Photo 10 - View of the downstream channel just beyond the Highway W embankment.

Photo 11 - View of the reservoir and rim showing the upstream dam embankment and the entrance to the principal spillway with the trashrack and vegetative growth shown.

Photo 12 - View of a dwelling from Highway W that appears to be in the downstream hazard zone.

Photo 1

Photo 2

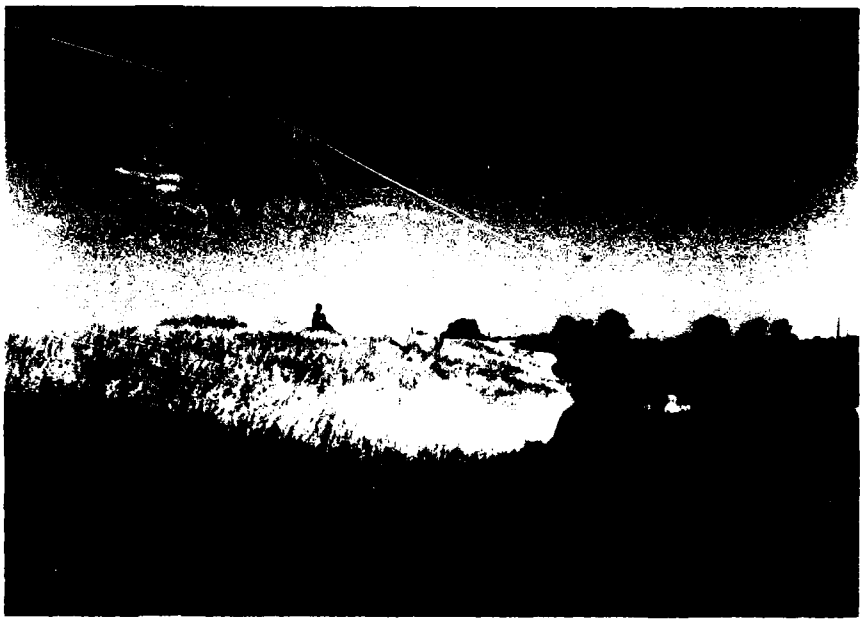


Photo 3

Photo 4

Photo 5

Photo 6

Kohl Irrigation Lake South Dam

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11

Photo 12

APPENDIX B

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

KOHL IRRIGATION LAKE SOUTH DAM

HYDROLOGIC AND HYDRAULIC DATA, ASSUMPTIONS AND METHODOLOGY

1. SCS Unit Hydrograph and HEC-1DB are used to develop the inflow hydrographs, and the hydrologic inputs are as follows:

   (a) Twenty-four hour probable maximum precipitation from Hydrometeorological Report No. 33, 24-hour 100-year rainfall and 24-hour 10-year rainfall of Hannibal, Missouri.

   (b) Drainage area:

   Drainage area above upstream (U/S) dam = 0.48 sq. mi.
   Drainage area between U/S dam and Kohl Irrigation Lake South Dam = 0.16 sq. mi.

   (c) Lag time:

   Lag time for U/S dam watershed = 0.43 hr.

   Lag time for Kohl Irrigation Lake South Dam watershed = 0.25 hr.

   (d) Hydrologic Soil Group:

   Soil Group "D" for both U/S dam and Kohl Irrigation Lake South Dam

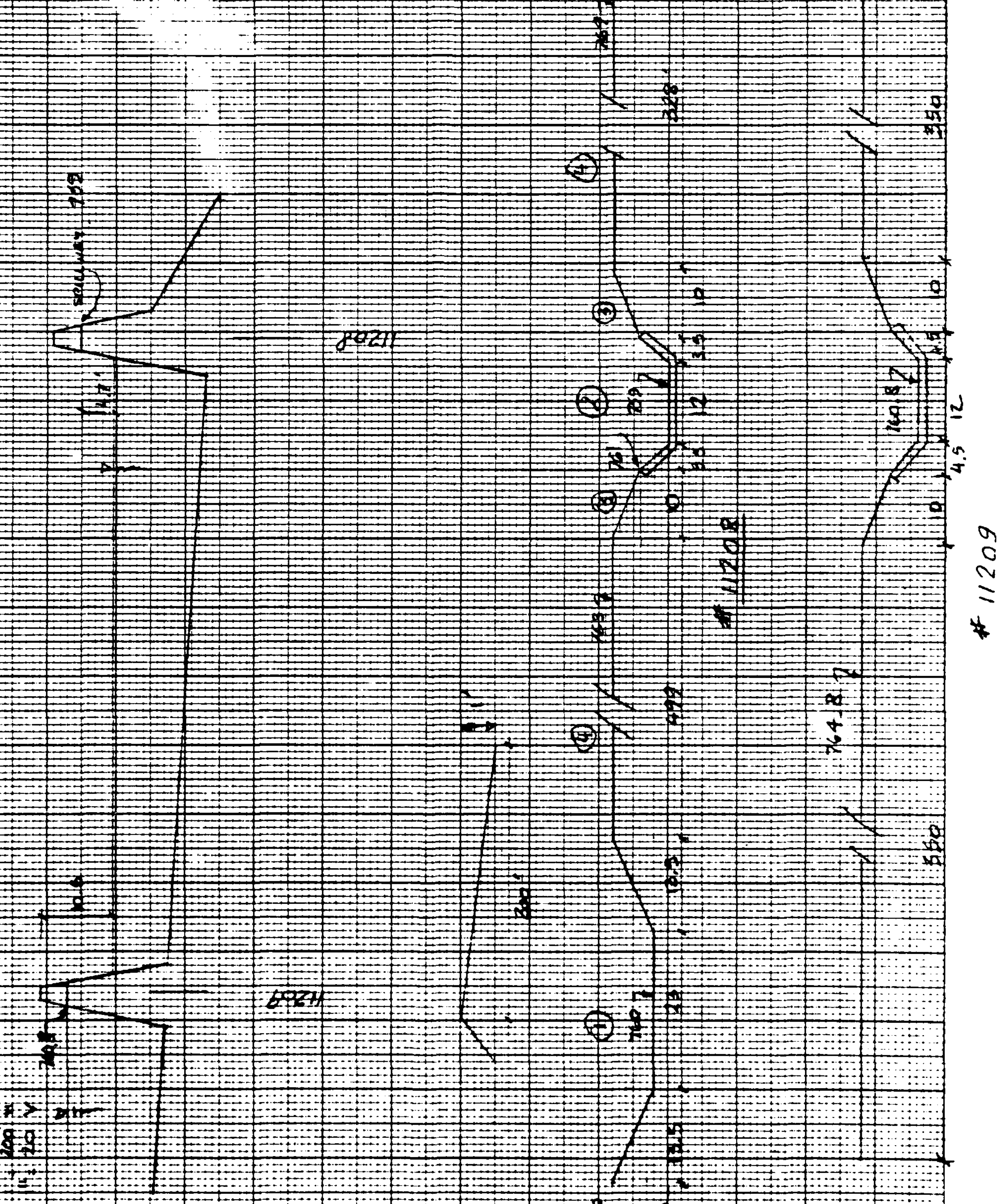
   (e) Runoff curve number:

   CN = 84 for AMC II and CN = 93 for AMC III for both U/S dam and Kohl Irrigation South Lake Dam.

2. Emergency spillway release rates are based on HEC-2 run assuming Manning's n = 0.03. Principal spillway release rates are determined by assuming critical flow. Flow rates over the dam are based on broad crested weir equation $Q = CLH^{3/2}$.

3. Floods are routed through the upstream reservoir and then through Kohl Irrigation Lake South to determine the capability of its spillways.

KOHL IRRIGATION LAKE SOUTH DAM AND U/S DAM SPILLWAY AND OVERTOP RATING CURVES



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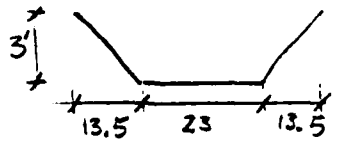
SHEET NO 2 OF 4

DAM SAFETY INSPECTION/MISSOURI - 1980 JOB NO. 1263

KOHL IRR. LAKE SOUTH DAM #11208 BY FZ DATE JUL 80

① EMERGENCY SPILLWAY

$S = \frac{1}{200}$



- 763
- 760

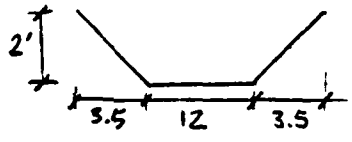
$y < 3$ $A = y(4.5y + 23)$, $P = 9.2y + 23$, $T = 9.0y + 23$

$y > 3$ $A = 50y - 40.5$, $P = 50.7$, $T = 50$

$Q = \sqrt{\frac{A^3 g}{T}}$

y_c	Q	y_n	Regime
1	144.7	1.34	Subcritical
2	453.7	2.50	
3	919.5	3.52	
4	1616.5	4.62	
5	2433.4	5.68	
6	3354.7	6.71	

② SPILLWAY assumed critical depth.



- 761
- 759

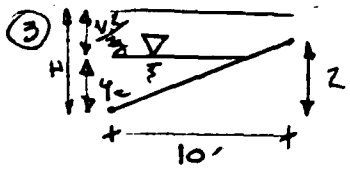
$y < 2$ $A = y_c(1.75 y_c + 12)$, $T = 12 + 3.5 y_c$

$y > 2$ $A = 19 y_c - 7$, $T = 19$

$H_2 = WSEL - 759$

$Q = \sqrt{\frac{A^3 g}{T}}$

③



$y_c < 2$ $y_c = \frac{4}{5}H$ $A = 2.5 y_c^2$, $T = 5 y_c$

$y_c > 2$ $y_c = \frac{2}{3}(H + 0.3)$ $A = 10(y_c - 1)$, $T = 10$

$Q = \sqrt{\frac{A^3 g}{T}}$

④ WEIR FLOW $Q_4 = C L H^{3/2}$ $L = 827$ $H = WSEL - 763$

$Q_{TOTAL} = Q_1 + Q_2 + 2xQ_3 + Q_4$

PRC ENGINEERING CONSULTANTS, INC.

SHEET NO 3 OF 4

DAM SAFETY INSPECTION / MISSOURI - 1988 JOB NO 1263

KOHL IRR. LAKE SOUTH DAM # 11208 BY FZ DATE JUL 88

① * See HEC 2 Section #3							WSEL	② * by iteration							③					Sub
Y_1	A_1	T_1	V_1	Q_1	$V_1^2/2g$	H_1		H_2	Y_{c2}	A_2	T_2	V_2	Q_2	$V_2^2/2g$	H_3	Y_{c3}	A_3	T_3	Q_3	Total $Q_1+Q_2+Q_3$
							759	.0	0	0	0	0	0	0						0
0	0	0	0	0	0	0	760	1.00	0.69	9.06	14.4	4.5	41	0.31						41
0.46	11.5	27.1	2.2	25	.07	0.53	760.53	1.53	1.06	14.7	15.7	5.5	81	0.47						106
0.71	18.4	29.3	2.7	50	.11	0.82	760.82	1.82	1.27	18.1	16.4	5.9	108	0.55						158
1.08	29.9	32.7	3.3	100	.17	1.25	761.25	2.25	1.58	23.4	17.5	6.6	153	0.67	0.25	0.20	0.1	1	0.	253
1.61	48.8	37.5	4.1	200	.26	1.87	761.87	2.87	2.04	31.7	19.0	7.3	232	0.83	0.87	0.70	1.2	3.5	4	440
2.02	64.9	41.2	4.6	300	.33	2.35	762.35	3.35	2.36	37.8	"	8.0	302	0.99	1.35	1.08	2.9	5.4	12	626
2.35	79.3	44.2	5.0	400	.39	2.75	762.75	3.75	2.62	42.8	"	8.5	365	1.13	1.75	1.40	4.9	7.0	23	811
2.65	92.8	46.4	5.4	500	.45	3.10	763.10	4.10	2.86	47.3	"	8.9	423	1.24	2.10	1.68	7.0	8.4	37	997
2.90	104.7	49.1	5.7	600	.51	3.41	763.41	4.41	3.06	51.2	"	9.3	477	1.35	2.41	1.93	9.3	9.6	52	1181
3.13	116.6	50.0	6.0	700	.56	3.69	763.69	4.91	3.25	54.8	"	9.6	527	1.44	2.69	2.13	11.3	10	68	1363
3.53	136.3	"	6.6	900	.68	4.21	764.21	5.21	3.60	61.3	"	10.2	625	1.61	3.21	2.47	14.7	"	101	1727
4.06	162.8	"	7.4	200	.84	4.90	764.90	5.90	4.06	70.1	"	10.9	764	1.84	3.90	2.93	19.3	"	153	2270
4.54	186.6	"	8.0	500	1.00	5.54	765.54	6.54	4.48	78.2	"	11.5	900	2.06	4.54	3.36	23.6	"	206	2812
4.98	209.0	"	8.6	800	1.15	6.14	766.14	7.14	4.88	85.8	"	12.1	1034	2.26	5.14	3.76	27.6	"	260	3354
5.41	230.4	"	9.1	1100	1.29	6.70	766.70	7.70	5.26	92.9	"	12.5	1165	2.44	5.70	4.13	31.3	"	315	3895

R-6

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SHEET NO. 4 OF 4

DAM SAFETY INSPECTION/MISSOURI-1980 JOB NO 1263

KOHL IRR. LAKE SOUTH DAM #11208 BY FZ DATE Jul 80

				Q	WSEL
SUB TOTAL	H_4	C_4	Q_4	Total	
0				0	759
41				41	760
106				106	760.53
158				158	760.82
253				253	761.25
440				440	761.87
626				626	762.35
811				811	762.75
997	0	0	0	1074	763.10
1181	0.10	2.93	77	1834	763 41
1363	0.41	3.01	653	2799	763.69
1727	0.69	3.03	1436	5071	764.21
2270	1.21	3.04	3344	8865	764.90
2812	1.90	3.04	6595	13038	765.54
3354	2.54	3.05	10226	17473	766.14
3895	3.14	3.07	14119	22017	766.70
	3.70	3.08	18122		

HEC-2 INPUT AND SUMMARY TABLE

```
**********
 HEC2 RELEASE DATED NOV 76 UPDATED JULY 1979
 ERROR CORR -  01.02.03
 MODIFICATION -  50.51.52.55
**********

T1      DAM  SAFETY INSPECTION
T2      KDHL IRRIGATION SOUTH LAKE DAM 11208
T3      EMERGENCY SPILLWAY RATING CURVE

J1  ICHECK    INQ     NINV     IDIR     STRT      METRIC    HVINS     U        WSEL      FQ
        0.      2.       0.       0.  -1.000000      0.00      0.0       0.   769.000     0.000

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH     FN        ALLOC     IBW      CHNIM     ITRACE
    1.000     0.000   -1.000    0.000    0.000     0.000     0.000    0.0000    0.000     0.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    38.000    6.000   29.000    4.000   26.000    10.000    42.000    3.000     5.000     17.000

J5  LPRNT     NUMSEC                  ********REQUESTED SECTION NUMBERS********

    -10.000  -10.000    0.000    0.000    0.000    0.000     0.000     0.000     0.000     0.000
NC      .030     .030     .030    0.000    0.000    0.000     0.000     0.000     0.000     0.000
QT    10.000   25.000   50.000  100.000  200.000  400.000   500.000   600.000   700.000
QT   900.000 1200.000 1500.000 1800.000 2100.000    0.000     0.000     0.000     0.000

X1      1.000    4.000    0.000   50.000    0.000    0.000     0.000     0.000     0.000     0.000
GR    762.000    0.000  759.000   13.500  759.000   36.500   762.000    50.000     0.000     0.000

X1      2.000    8.000    0.000    8.000  100.000  100.000   100.000     0.000      .500     0.000

X1      3.000    0.000    0.000    0.000  100.000  100.000   100.000     0.000      .500     0.000
EJ      0.000    0.000    0.000    0.000    0.000    0.000     0.000     0.000     0.000     0.000
```

HEC2 RELEASE DATED NOV 76 UPDATED JULY 1979
ERROR CORR - 31.02,03
MODIFICATION - 50,51,52,53

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

EMERGENCY SPILLWAY RATIN

SUMMARY PRINTOUT

	SECNO	DEPTH	AREA	TOPWID	VCH	HV	Q	EG	10K*S	K*XNCH
*	1.000	.32	7.92	25.92	3.16	.15	25.00	779.48	197.84	30.00
*	1.000	.51	12.84	27.57	3.90	.24	50.00	759.74	172.27	30.00
*	1.000	.79	20.98	30.11	4.77	.35	100.00	760.14	150.99	30.00
*	1.000	1.22	34.76	33.98	5.75	.51	200.00	760.73	132.28	30.00
*	1.000	1.56	46.74	37.02	6.42	.64	300.00	761.20	124.55	30.00
*	1.000	1.85	58.83	39.67	6.89	.74	400.00	761.59	118.23	30.00
*	1.000	2.11	68.50	41.98	7.30	.83	500.00	761.94	114.69	30.00
*	1.000	2.34	78.64	44.19	7.63	.90	600.00	762.25	111.41	30.00
*	1.000	2.56	88.42	46.05	7.92	.97	700.00	762.53	108.79	30.00
*	1.000	2.76	107.27	49.60	8.39	1.09	900.00	763.05	104.37	30.00
*	1.000	3.41	129.91	50.00	9.24	1.32	1200.00	763.73	101.21	30.00
*	1.000	3.83	150.90	50.00	9.94	1.53	1500.00	764.36	98.07	30.00
*	1.000	4.22	170.36	50.00	10.57	1.73	1800.00	764.95	96.14	30.00
*	1.000	4.59	188.84	50.00	11.12	1.92	2100.00	765.51	94.55	30.00
	2.000	.57	14.28	28.34	1.75	.05	25.00	760.11	30.89	30.00
	2.000	.81	21.70	30.32	2.38	.08	50.00	760.40	34.09	30.00
	2.000	1.17	33.31	33.59	3.00	.14	100.00	760.81	37.55	30.00
	2.000	1.68	51.51	38.16	3.88	.23	200.00	761.42	41.71	30.00
	2.000	2.08	67.09	41.67	4.47	.31	300.00	761.89	43.83	30.00
	2.000	2.40	81.25	44.63	4.92	.38	400.00	762.28	45.14	30.00
	2.000	2.68	94.48	47.22	5.29	.43	500.00	762.63	46.03	30.00
	2.000	2.93	107.15	49.57	5.60	.49	600.00	762.93	46.53	30.00
	2.000	3.17	118.05	50.00	5.93	.55	700.00	763.22	46.88	30.00
	2.000	3.56	137.53	50.00	6.54	.67	900.00	763.73	47.48	30.00
	2.000	4.08	163.34	50.00	7.35	.84	1200.00	764.41	48.82	30.00
	2.000	4.54	186.81	50.00	8.03	1.00	1500.00	765.04	49.91	30.00
	2.000	4.98	208.84	50.00	8.62	1.15	1800.00	765.63	50.65	30.00
	2.000	5.38	229.50	50.00	9.19	1.31	2100.00	766.19	52.01	30.00

SECNO	DEPTH	AREA	TOPWID	VCH	HV	Q	EG	10K*S	K*XNCH
3.000	.46	11.89	27.14	2.17	.07	25.00	760.93	60.15	30.00
3.000	.71	18.64	29.40	2.68	.11	50.00	760.82	54.27	30.00
3.000	1.00	23.99	32.68	3.34	.17	100.00	761.25	51.57	30.00
3.000	1.61	48.75	37.50	4.16	.26	200.00	761.47	48.96	30.00
3.000	2.02	64.98	41.20	4.62	.33	300.00	762.35	48.19	30.00
3.000	2.33	79.30	44.23	5.04	.41	400.00	762.75	48.36	30.00
3.000	2.65	92.77	46.89	5.39	.46	500.00	763.13	48.46	30.00
3.000	2.91	104.86	49.16	5.72	.51	600.00	763.41	48.43	30.00
3.000	3.13	116.55	50.00	6.01	.56	700.00	763.69	48.76	30.00
3.000	3.43	136.30	50.00	6.60	.68	900.00	764.21	48.33	30.00
3.000	4.16	152.80	50.00	7.37	.84	1200.00	764.90	48.53	30.00
3.000	4.54	186.75	50.00	8.03	1.00	1500.00	765.54	49.97	30.00
3.000	4.98	208.96	50.00	8.61	1.15	1800.00	766.14	50.56	30.00
3.000	5.42	230.55	50.00	9.11	1.27	2100.00	766.71	50.63	30.00

SUMMARY OF ERROR

CAUTION SECNO= 1.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 2 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 3 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 4 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 5 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 6 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 7 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 8 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE= 9 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=10 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=11 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=12 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=13 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 1.000 PROFILE=14 CRITICAL DEPTH ASSUMED

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF 1

DAM NAME: JOHN IRWIN LAKE SOUTH / ID NO.: 11209 JOB NO. 263

RESERVOIR ELEVATION - AREA DATA BY JEK DATE 9/29/80

ELEV. (M.S.L.) (Ft.)	RESERVOIR SURFACE AREA (Acres)	CUMULATIVE STORAGE (Ac-Ft)	REMARKS
745	0	0	From Survey Notes, Estimated Streambed
749	1.1	2.2	" "
751	2.9	6.2	" "
753	6.0	15.1	" "
755	8.2	29.3	" "
757	10.8	48.3	" "
759	15.4	74.5	Principal Spillway Crest
760	18.2	91.3	Emergency Spillway Crest
761	21.1	111	Top of Dam
770	45	408.5	Measured from U.S.G.S. Quad

Terry Hill L.C. | 7-6-76

FW: W. Blakely C.E.T. | Fred Kohl & Ralph Talbert Irr. Res.

MESSAGE

	Part on Kohl			Part on Talbert			Total		
El.	Ar.	Sto.		Ar.	Sto		Ar.	Sto.	
80	0.0	0.0		0.0	0.0		0.0	0.0	
84	1.1	2.2		0.0	0.0		1.1	2.2	
86	2.9	6.2		0.2	0.1		3.1	6.3	
88	6.0	15.1		0.8	1.1		6.8	16.2	
90	8.2	27.3		1.5	3.4		9.7	31.6	
92	10.8	48.3		2.3	7.2		13.1	~~61.7~~ 55.5	
94	15.4	74.5		4.3	13.8		19.7	88.3	
96	21.1	111.0		9.2	27.3		30.3	138.5	

Top of road west culvert 100.0 fl. west culvert 93.8
fl. of east culvert 92.9 & ditch @ 85.0
fl. of ditch @ Kohl dam 80.2 TBM El. 93.2 Top of Rw marker @ South end of Kohl dam. Advise if you need more info.

REPLY Buck Blakely

11208

KOHL IRRIGATION LAKE SOUTH DAM AND UPSTREAM DAM RESERVOIR AREA & STORAGE (SUPPLIED BY OWNER)

ECI-4 **PRC ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION / MISSOURI — SHEET NO. 1 OF 1

DAM NAME: KOHL IRR. LAKE SOUTH DAM 11208 — JOB NO. 1263

UNIT HYDROGRAPH PARAMETERS — BY FZ DATE JUL 80

1) DRAINAGE AREA, $A = 0.160$ sq. mi = (102 acres)

2) LENGTH OF STREAM, $L = (1.45" \times 2000' = 2900') = 0.55$ mi.

3) ELEVATION AT DRAINAGE DIVIDE ALONG THE LONGEST STREAM,

$H_1 = 779$

4) ELEVATION OF RESERVOIR AT SPILLWAY CREST, $H_2 = 759$

5) ELEVATION OF CHANNEL BED AT 0.85L, $E_{85} = 778$

6) ELEVATION OF CHANNEL BED AT 0.10L, $E_{10} = 768$

7) AVERAGE SLOPE OF THE CHANNEL, $S_{AVG} = (E_{85} - E_{10})/0.75L = 0.005$

8) TIME OF CONCENTRATION:

A) BY KIRPICH'S EQUATION,

$t_c = [(11.9 \times L^3)/(H_1 - H_2)]^{0.385} = 0.41$ hr.

B) BY VELOCITY ESTIMATE,

SLOPE = 0.5% $\Rightarrow$ AVG. VELOCITY = 2 fps

$t_c = L/V = \frac{2900}{2} \times \frac{1}{3600} = 0.4$ hr.

USE $t_c = 0.41$

9) LAG TIME, $t_l = 0.6\, t_c = 0.25$ hr.

10) UNIT DURATION, $D \leq t_l/3 = 0.082$ hr. < 0.083 hr.

USE $D = 0.083$ hr.

11) TIME TO PEAK, $T_p = D/2 + t_l = 0.29$ hr.

12) PEAK DISCHARGE,

$q_p = (484 \times A)/T_p = 266$ cfs

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
                                    DAM SAFETY INSPECTION - MISSOURI
     KOHL IRRIGATION SOUTH LAKE DAM (MO.11208)
                                        DMF
     300       0       5       0       0       0       0       0       0       0
       5
       1       1       1
       1
    11209DAM                                                   1
    RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11209
       1       2    .477               .477       1                               1
            14.8     100     120     130
                                                          -1      -03
              .43
                       1
    11120?DAM                                                  1
    ROUTE HYDROGRAPH THROUGH DAM 11209
                                       1       1
       1                                                -760.8      -1
  760.8   761.53  762.23  763.59  764.79  764.94  765.09  765.39  765.84  766.59
767.34  767.09
       0      25      75     241     499     647     910    1634    3075    6195
 13047   14543
       0      .1     1.1     3.4     7.2    13.8    25.5    27.3    49.5   294.3
     749     751     753     755     757     759   760.8     761   762.8     770
   760.8
   762.8
      10      .5     759      1.   760.8   765.80
```

```
                11208DAM                                                        1
K1              RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11208
K     1             2       .16                 .15       1                                 1
K1                  94.6      100       120       130
K                                                          -1       -93
K2                .25
K                           1
K     21120DAM                                                        1
K1              COMBINE HYDROGRAPHS
K     11120DAM                                                        1
K1              ROUTE HYDROGRAPH THROUGH DAM 11208
K                                             1         1
K1      1                                                    -759       -1
K4    758       760    760.53    760.82    761.25    761.67    762.35    762.75    763.1    763.41
K4763.69    764.21    764.99
K       0        41       106       158       253       440       626       811     1074      1934
K   3799      5471      6865
K       0       3.2       6.2      13.1      23.3      46.3      74.5      91.3      111     408.5
K     745       749       751       753       755       757       759       760       761       778
K1    759
K1    761
K
```

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

RUN DATE= 80/08/26.
TIME= 10:22.28.

DAM SAFETY INSPECTION - MISSOURI
KUHL IRRIGATION SOUTH LAKE DAM INO.11209
PMF

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	0	0

JOPER	NWT	LKOPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 1 LRTIO= 1

RTIOS= 1.00

SUB-AREA RUNOFF COMPUTATION

RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11209

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
209DAM	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.49	0.00	.49	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.80	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LKOPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-93.00	0.00	0.00

CURVE NO = -93.00 HYDRAULIC = -1.00 EFFECT CN = 93.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .43

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 28 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .43 VOL= 1.00

41.	124.	257.	404.	478.	485.	441.	374.	279.	202.	
150.	115.	87.	65.	49.	36.	27.	20.	15.	12.	

A1-17

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	181	.21	.20	.00	550.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	182	.21	.20	.00	601.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	183	.21	.20	.00	639.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	184	.21	.20	.00	667.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	185	.21	.20	.00	688.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	186	.21	.20	.00	703.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	187	.25	.24	.00	717.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	188	.25	.24	.00	731.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	189	.25	.24	.00	749.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	190	.25	.24	.00	770.
1.01	.55	11	.01	0.00	.01	0.	1.01	13.25	191	.25	.24	.00	794.
1.01	1.00	12	.01	.00	.01	0.	1.01	13.30	192	.25	.24	.00	816.
1.01	1.05	13	.01	.00	.01	0.	1.01	13.35	193	.25	.24	.00	837.
1.01	1.10	14	.01	.00	.01	0.	1.01	13.40	194	.25	.24	.00	854.
1.01	1.15	15	.01	.00	.01	0.	1.01	13.45	195	.25	.24	.00	867.
1.01	1.20	16	.01	.00	.01	0.	1.01	13.50	196	.25	.24	.00	876.
1.01	1.25	17	.01	.00	.01	0.	1.01	13.55	197	.25	.24	.00	883.
1.01	1.30	18	.01	.00	.01	0.	1.01	14.00	198	.25	.24	.00	889.
1.01	1.35	19	.01	.00	.01	0.	1.01	14.05	199	.31	.31	.00	899.
1.01	1.40	20	.01	.00	.01	0.	1.01	14.10	170	.31	.31	.00	906.
1.01	1.45	21	.01	.00	.01	0.	1.01	14.15	171	.31	.31	.00	924.
1.01	1.50	22	.01	.00	.01	0.	1.01	14.20	172	.41	.31	.00	950.
1.01	1.55	23	.01	.00	.01	0.	1.01	14.25	173	.31	.31	.00	981.
1.01	2.00	24	.01	.00	.01	10.	1.01	14.30	174	.31	.31	.00	1012.
1.01	2.05	25	.01	.00	.01	11.	1.01	14.35	175	.31	.31	.00	1040.
1.01	2.10	26	.01	.01	.01	12.	1.01	14.40	176	.31	.31	.00	1063.
1.01	2.15	27	.01	.01	.01	13.	1.01	14.45	177	.31	.31	.00	1081.
1.01	2.20	28	.01	.01	.01	14.	1.01	14.50	178	.31	.31	.00	1094.
1.01	2.25	29	.01	.01	.01	15.	1.01	14.55	179	.31	.31	.00	1103.
1.01	2.30	30	.01	.01	.01	16.	1.01	15.00	180	.31	.31	.00	1111.
1.01	2.35	31	.01	.01	.01	17.	1.01	15.05	181	.19	.19	.00	1111.
1.01	2.40	32	.01	.01	.01	18.	1.01	15.10	182	.37	.37	.00	1108.
1.01	2.45	33	.01	.01	.01	19.	1.01	15.15	183	.37	.37	.00	1104.
1.01	2.50	34	.01	.01	.01	20.	1.01	15.20	184	.56	.56	.00	1113.
1.01	2.55	35	.01	.01	.01	21.	1.01	15.25	185	.65	.65	.00	1159.
1.01	3.00	36	.01	.01	.01	22.	1.01	15.30	186	1.59	1.59	.00	1289.
1.01	3.05	37	.01	.01	.01	22.	1.01	15.35	187	2.62	2.61	.00	1585.
1.01	3.10	38	.01	.01	.01	23.	1.01	15.40	188	1.03	1.03	.00	2053.
1.01	3.15	39	.01	.01	.01	24.	1.01	15.45	189	.65	.65	.00	2654.
1.01	3.20	40	.01	.01	.01	25.	1.01	15.50	190	.56	.56	.00	3213.
1.01	3.25	41	.01	.01	.01	25.	1.01	15.55	191	.37	.37	.00	3532.
1.01	3.30	42	.01	.01	.01	26.	1.01	16.00	192	.37	.37	.00	3587.
1.01	3.35	43	.01	.01	.01	27.	1.01	16.05	193	.29	.29	.00	3427.
1.01	3.40	44	.01	.01	.01	27.	1.01	16.10	194	.29	.29	.00	3116.
1.01	3.45	45	.01	.01	.01	28.	1.01	16.15	195	.29	.29	.00	2716.
1.01	3.50	46	.01	.01	.01	28.	1.01	16.20	196	.29	.29	.00	2346.
1.01	3.55	47	.01	.01	.01	29.	1.01	16.25	197	.29	.29	.00	2049.
1.01	4.00	48	.01	.01	.00	29.	1.01	16.30	198	.29	.29	.00	1814.
1.01	4.05	49	.01	.01	.00	30.	1.01	16.35	199	.29	.29	.00	1624.
1.01	4.10	50	.01	.01	.00	30.	1.01	16.40	200	.29	.29	.00	1465.
1.01	4.15	51	.01	.01	.00	31.	1.01	16.45	201	.29	.29	.00	1378.
1.01	4.20	52	.01	.01	.00	31.	1.01	16.50	202	.29	.29	.00	1297.
1.01	4.25	53	.01	.01	.00	32.	1.01	16.55	203	.29	.29	.00	1237.
1.01	4.30	54	.01	.01	.00	32.	1.01	17.00	204	.29	.29	.00	1193.
1.01	4.35	55	.01	.01	.00	32.	1.01	17.05	205	.23	.23	.00	1157.

1.01	5.40	58	.01	.01	.00	34.	1.01	17.10	206	.23	.23	.00	1134.
1.01	5.45	59	.01	.01	.00	34.	1.01	17.15	207	.23	.23	.00	1098.
1.01	5.50	60	.01	.01	.00	34.	1.01	17.20	208	.23	.23	.00	1051.
1.01	5.55	61	.01	.01	.00	34.	1.01	17.25	209	.23	.23	.00	1011.
1.01	6.00	62	.01	.01	.00	34.	1.01	17.30	210	.23	.23	.00	979.
1.01	6.05	63	.01	.01	.00	34.	1.01	17.35	211	.23	.23	.00	940.
1.01	6.10	64	.01	.01	.00	35.	1.01	17.40	212	.23	.23	.00	911.
1.01	6.15	65	.01	.01	.00	35.	1.01	17.45	213	.23	.23	.00	889.
1.01	6.20	66	.01	.01	.00	35.	1.01	17.50	214	.23	.23	.00	873.
1.01	6.25	67	.01	.01	.00	36.	1.01	17.55	215	.23	.23	.00	862.
1.01	6.30	68	.01	.01	.00	36.	1.01	18.00	216	.23	.23	.00	854.
1.01	6.35	69	.01	.01	.00	36.	1.01	18.05	217	.02	.02	.00	840.
1.01	6.40	70	.01	.01	.00	37.	1.01	18.10	218	.02	.02	.00	810.
1.01	6.45	71	.01	.01	.00	37.	1.01	18.15	219	.02	.02	.00	754.
1.01	6.50	72	.01	.01	.00	37.	1.01	18.20	220	.02	.02	.00	669.
1.01	6.55	73	.01	.01	.00	37.	1.01	18.25	221	.02	.02	.00	570.
1.01	7.00	74	.01	.01	.00	38.	1.01	18.30	222	.02	.02	.00	469.
1.01	7.05	75	.07	.05	.01	40.	1.01	18.35	223	.02	.02	.00	378.
1.01	7.10	76	.07	.05	.01	45.	1.01	18.40	224	.02	.02	.00	300.
1.01	7.15	77	.07	.06	.01	57.	1.01	18.45	225	.02	.02	.00	242.
1.01	7.20	78	.07	.06	.01	75.	1.01	18.50	226	.02	.02	.00	201.
1.01	7.25	79	.07	.06	.01	96.	1.01	18.55	227	.02	.02	.00	170.
1.01	7.30	80	.07	.06	.01	119.	1.01	19.00	228	.02	.02	.00	146.
1.01	7.35	81	.07	.06	.01	139.	1.01	19.05	229	.02	.02	.00	128.
1.01	7.40	82	.07	.06	.01	158.	1.01	19.10	230	.02	.02	.00	114.
1.01	7.45	83	.07	.06	.01	172.	1.01	19.15	231	.02	.02	.00	104.
1.01	7.50	84	.07	.06	.01	183.	1.01	19.20	232	.02	.02	.00	97.
1.01	7.55	85	.07	.06	.01	192.	1.01	19.25	233	.02	.02	.00	92.
1.01	8.00	86	.07	.06	.01	199.	1.01	19.30	234	.02	.02	.00	87.
1.01	8.05	87	.07	.06	.01	205.	1.01	19.35	235	.02	.02	.00	84.
1.01	8.10	88	.07	.06	.01	210.	1.01	19.40	236	.02	.02	.00	82.
1.01	8.15	89	.07	.06	.01	214.	1.01	19.45	237	.02	.02	.00	80.
1.01	8.20	90	.07	.06	.01	218.	1.01	19.50	238	.02	.02	.00	79.
1.01	8.25	91	.07	.06	.01	221.	1.01	19.55	239	.02	.02	.00	78.
1.01	8.30	92	.07	.06	.01	223.	1.01	20.00	240	.02	.02	.00	77.
1.01	8.35	93	.07	.06	.00	225.	1.01	20.05	241	.02	.02	.00	76.
1.01	8.40	94	.07	.06	.00	227.	1.01	20.10	242	.02	.02	.00	76.
1.01	8.45	95	.07	.06	.00	229.	1.01	20.15	243	.02	.02	.00	76.
1.01	8.50	96	.07	.06	.00	230.	1.01	20.20	244	.02	.02	.00	76.
1.01	8.55	97	.07	.06	.00	231.	1.01	20.25	245	.02	.02	.00	76.
1.01	9.00	98	.07	.06	.00	233.	1.01	20.30	246	.02	.02	.00	76.
1.01	9.05	99	.07	.06	.00	234.	1.01	20.35	247	.02	.02	.00	76.
1.01	9.10	99	.07	.06	.00	235.	1.01	20.40	248	.02	.02	.00	76.
1.01	9.15	99	.07	.06	.00	236.	1.01	20.45	249	.02	.02	.00	76.
1.01	9.20	100	.07	.07	.00	236.	1.01	20.50	250	.02	.02	.00	76.
1.01	9.25	101	.07	.07	.00	237.	1.01	20.55	251	.02	.02	.00	76.
1.01	9.30	102	.07	.07	.00	238.	1.01	21.00	252	.02	.02	.00	76.
1.01	9.35	103	.07	.07	.00	238.	1.01	21.05	253	.02	.02	.00	76.
1.01	9.40	104	.07	.07	.00	239.	1.01	21.10	254	.02	.02	.00	76.
1.01	9.45	105	.07	.07	.00	239.	1.01	21.15	255	.02	.02	.00	76.
1.01	9.50	106	.07	.07	.00	240.	1.01	21.20	256	.02	.02	.00	76.
1.01	9.55	107	.07	.07	.00	240.	1.01	21.25	257	.02	.02	.00	76.
1.01	9.00	108	.07	.07	.00	241.	1.01	21.30	258	.02	.02	.00	76.
1.01	9.05	109	.07	.07	.00	241.	1.01	21.35	259	.02	.02	.00	76.
1.01	9.10	110	.07	.07	.00	242.	1.01	21.40	260	.02	.02	.00	76.
1.01	9.15	111	.07	.07	.00	242.	1.01	21.45	261	.02	.02	.00	76.
1.01	9.20	112	.07	.07	.00	243.	1.01	21.50	262	.02	.02	.00	76.
1.01	9.25	113	.07	.07	.00	243.	1.01	21.55	263	.02	.02	.00	76.
1.01	9.30	114	.07	.07	.00	243.	1.01	22.00	264	.02	.02	.00	76.
1.01	9.35	115	.07	.07	.00	243.	1.01	22.05	265	.02	.02	.00	76.

1.01	9.40	116	.07	.07	.00	244.	1.01	22.10	268	.02	.02	.00	76.
1.01	9.45	117	.07	.07	.00	244.	1.01	22.15	267	.02	.02	.00	76.
1.01	9.50	118	.07	.07	.00	244.	1.01	22.20	268	.02	.02	.00	76.
1.01	9.55	119	.07	.07	.00	245.	1.01	22.25	269	.02	.02	.00	76.
1.01	10.00	120	.07	.07	.00	245.	1.01	22.30	270	.02	.02	.00	76.
1.01	10.05	121	.07	.07	.00	245.	1.01	22.35	271	.02	.02	.00	76.
1.01	10.10	122	.07	.07	.00	245.	1.01	22.40	272	.02	.02	.00	76.
1.01	10.15	123	.07	.07	.00	245.	1.01	22.45	273	.02	.02	.00	76.
1.01	10.20	124	.07	.07	.00	246.	1.01	22.50	274	.02	.02	.00	76.
1.01	10.25	125	.07	.07	.00	246.	1.01	22.55	275	.02	.02	.00	76.
1.01	10.30	126	.07	.07	.00	246.	1.01	23.00	276	.02	.02	.00	76.
1.01	10.35	127	.07	.07	.00	246.	1.01	23.05	277	.02	.02	.00	76.
1.01	10.40	128	.07	.07	.00	246.	1.01	23.10	278	.02	.02	.00	76.
1.01	10.45	129	.07	.07	.00	247.	1.01	23.15	279	.02	.02	.00	76.
1.01	10.50	130	.07	.07	.00	247.	1.01	23.20	280	.02	.02	.00	76.
1.01	10.55	131	.07	.07	.00	247.	1.01	23.25	281	.02	.02	.00	76.
1.01	11.00	132	.07	.07	.00	247.	1.01	23.30	282	.02	.02	.00	76.
1.01	11.05	133	.07	.07	.00	247.	1.01	23.35	283	.02	.02	.00	76.
1.01	11.10	134	.07	.07	.00	247.	1.01	23.40	284	.02	.02	.00	76.
1.01	11.15	135	.07	.07	.00	247.	1.01	23.45	285	.02	.02	.00	76.
1.01	11.20	136	.07	.07	.00	248.	1.01	23.50	286	.02	.02	.00	76.
1.01	11.25	137	.07	.07	.00	248.	1.01	23.55	287	.02	.02	.00	76.
1.01	11.30	138	.07	.07	.00	248.	1.02	0.00	288	.02	.02	.00	76.
1.01	11.35	139	.07	.07	.00	248.	1.02	.05	289	0.00	0.00	0.00	75.
1.01	11.40	140	.07	.07	.00	249.	1.02	.10	290	0.00	0.00	0.00	72.
1.01	11.45	141	.07	.07	.00	249.	1.02	.15	291	0.00	0.00	0.00	67.
1.01	11.50	142	.07	.07	.00	249.	1.02	.20	292	0.00	0.00	0.00	59.
1.01	11.55	143	.07	.07	.00	249.	1.02	.25	293	0.00	0.00	0.00	49.
1.01	12.00	144	.07	.07	.00	249.	1.02	.30	294	0.00	0.00	0.00	39.
1.01	12.05	145	.21	.20	.00	264.	1.02	.35	295	0.00	0.00	0.00	30.
1.01	12.10	146	.21	.20	.00	271.	1.02	.40	296	0.00	0.00	0.00	22.
1.01	12.15	147	.21	.20	.00	306.	1.02	.45	297	0.00	0.00	0.00	17.
1.01	12.20	148	.21	.20	.00	360.	1.02	.50	298	0.00	0.00	0.00	12.
1.01	12.25	149	.21	.20	.00	425.	1.02	.55	299	0.00	0.00	0.00	9.
1.01	12.30	150	.21	.20	.00	481.	1.02	1.00	300	0.00	0.00	0.00	7.
									SUM	31.98	31.09	.89	114799.
										(812.)(	790.)(	23.)(	3250.75)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3587.	1234.	399.	383.	114776.
CMS	102.	35.	11.	11.	3250.
INCHES		24.06	31.09	31.09	31.09
MM		611.21	789.63	789.63	789.63
AC-FT		612.	790.	790.	790.
THOUS CU M		755.	975.	975.	975.

HYDROGRAPH AT STA2000AM FOR PLAN 1, RTIO 1

0.	0.	3.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	1.	2.	3.	4.	5.
6.	7.	8.	10.	11.	12.	13.	14.	15.	16.
17.	18.	19.	20.	21.	22.	22.	23.	24.	25.
26.	26.	27.	27.	28.	28.	29.	29.	30.	30.
31.	31.	32.	32.	32.	33.	33.	33.	34.	34.
35.	35.	35.	35.	36.	36.	36.	37.	37.	37.
37.	38.	40.	45.	57.	75.	96.	119.	139.	158.
172.	183.	192.	199.	205.	210.	214.	218.	221.	223.
225.	227.	229.	230.	231.	233.	234.	235.	236.	236.

239.	238.	238.	238.	238.	240.	240.	241.	241.	242.	
242.	243.	243.	243.	243.	244.	244.	244.	245.	245.	
246.	246.	246.	246.	246.	246.	246.	246.	247.	247.	
247.	247.	247.	247.	247.	248.	248.	248.	248.	248.	
248.	248.	248.	248.	254.	271.	306.	368.	4254.	691.	
554.	601.	639.	667.	688.	703.	717.	731.	749.	770.	
794.	816.	837.	854.	867.	876.	883.	889.	895.	906.	
924.	950.	981.	1012.	1040.	1068.	1081.	1094.	1103.	1111.	
1114.	11084	1104.	1113.	1159.	1289.	1585.	2083.	2654.	3215.	
3532.	3587.	3427.	3115.	2716.	2346.	2049.	1814.	1628.	1485.	
1378.	1297.	1237.	1193.	1157.	1124.	1090.	1051.	1011.	974.	
940.	911.	881.	873.	868.	854.	840.	810.	754.	669.	
570.	469.	378.	300.	242.	201.	170.	146.	128.	114.	
104.	97.	92.	87.	84.	82.	80.	79.	78.	77.	
76.	76.	76.	76.	76.	76.	76.	76.	76.	76.	
76.	76.	76.	76.	76.	76.	76.	76.	76.	76.	
76.	76.	76.	76.	76.	76.	76.	76.	76.	76.	
76.	76.	76.	76.	76.	76.	76.	76.	76.	76.	
76.	76.	76.	76.	76.	76.	76.	76.	76.	76.	
76.	76.	76.	76.	76.	76.	76.	76.	75.	72.	
67.	59.	49.	39.	30.	22.	17.	12.	9.	7.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3587.	1234.	399.	383.	114776.
CMS	102.	35.	11.	11.	3250.
INCHES		24.36	31.09	31.09	31.09	
MM		511.21	789.63	789.63	789.63	
AC-FT		612.	790.	790.	790.	
THOUS CU M		755.	975.	975.	975.	

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH DAM 11289

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
2291DAM	1	0	0	0	0	1	0	0

ROUTING DATA

GLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTPL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-761.	-1

STAGE	760.00	761.53	762.23	763.59	764.79	766.94	765.09	765.39	765.84	766.59
	767.34	767.09								
FLOW	0.00	25.00	75.00	241.00	499.00	647.00	410.00	1634.00	3075.00	6198.00
	10867.00	14543.00								
CAPACITY	0.	0.	1.	3.	7.	19.	26.	27.	58.	394.
ELEVATION	749.	751.	753.	755.	757.	759.	761.	761.	763.	770.

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH DAM 11208

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
208DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.100	0.000	-759.	-1

STAGE	759.00	760.00	760.51	760.82	761.25	761.47	762.35	762.78	763.10	763.41
	763.80	764.21	764.79							
FLOW	0.00	41.00	106.00	159.00	253.00	440.00	626.00	811.00	1079.00	1336.00
	2799.00	5071.00	8866.00							
CAPACITY=	0.	2.	6.	15.	29.	48.	78.	91.	111.	409.
ELEVATION=	745.	749.	751.	753.	755.	757.	759.	760.	761.	770.

CHFL	XPLID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
759.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

IOPEL	COOD	EXPD	DAMWID
761.0	0.0	0.0	0.

STATION 208DAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

NO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.05	1	.08	0.	0.	75.	759.0
1.01	.10	2	.17	0.	0.	75.	759.0
1.01	.15	3	.25	0.	0.	75.	759.0
1.01	.20	4	.33	0.	0.	75.	759.0
1.01	.25	5	.42	0.	0.	75.	759.0
1.01	.30	6	.50	0.	0.	75.	759.0
1.01	.35	7	.58	0.	0.	75.	759.0
1.01	.40	8	.67	0.	0.	75.	759.0
1.01	.45	9	.75	0.	0.	75.	759.0
1.01	.50	10	.83	0.	0.	75.	759.0
1.01	.55	11	.92	0.	0.	75.	759.0
1.01	1.00	12	1.00	0.	0.	75.	759.0
1.01	1.05	13	1.08	0.	0.	75.	759.0
1.01	1.10	14	1.17	0.	0.	75.	759.0
1.01	1.15	15	1.25	1.	0.	75.	759.0
1.01	1.20	16	1.33	1.	0.	75.	759.0
1.01	1.25	17	1.42	1.	0.	75.	759.0
1.01	1.30	18	1.50	2.	0.	75.	759.0
1.01	1.35	19	1.58	2.	0.	75.	759.0

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 1.00
HYDROGRAPH AT	209DAM	.48 (1.24)	1	3587. (101.58)
ROUTED TO	209DAM	.48 (1.24)	1	3497. (99.02)
HYDROGRAPH AT	208DAM	.16 (.41)	1	1539. (43.59)
COMBINED	208DAM	.64 (1.65)	1	4572. (129.48)
ROUTED TO	208DAM	.64 (1.65)	1	4247. (120.25)

U/S DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	760.80	760.80	762.80
STORAGE	26.	26.	50.
OUTFLOW	0.	0.	145.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	765.89	3.09	155.	5500.	11.92	16.08	16.00

KOHL IRRIGATION LAKE SOUTH DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	759.00	759.00	761.00
STORAGE	75.	75.	111.
OUTFLOW	0.	0.	198.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	764.02	3.02	211.	4847.	13.58	16.08	0.00

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
**********
     1                 I1     DAM SAFETY INSPECTION - MISSOURI
     2                 I2       KOHL IRRIGATION SOUTH LAKE DAM (MO.11208)
     3                 I3                                  FIFTY PERCENT PMF
     4                 IT      300        0        5        0        0        0        0        0        0        0
     5                 IO        1        5
     6                 JD        1        1        1
     7                 JD1     .5
     8                 KK                11208DAM                                                  1
     9                 KM1               RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11208
    10                 BA        1        2     .477                .477        1                          1
    11                 PB                24.6      130      120      130
    12                 LS                                                                  -1      -93
    13                 LS2                .43
    14                 KK                                  1
    15                 KK                11120SDAM                                                 1
    16                 KM1               ROUTE HYDROGRAPH THROUGH DAM 11208
    17                 KY                                            1        1
    18                 KY1       1                                                     -760.8      -1
    19                 KY4   760.8   761.93   762.23   762.59   764.79   764.94   765.09   765.39   765.84   766.59
    20                 KY4767.34   767.09
    21                 KY5       0       25       75      241      499      647      910     1634     3075     6195
    22                 KY5   10047   14543
    23                 KS        0       .1      1.1      3.4      7.2     13.8     25.5     27.3     49.5    294.3
    24                 KE      749      751      753      755      757      759    760.8      761    762.8      770
    25                 KE1   760.8
    26                 KD    762.8
    27                 KB       10       .5      759       1.    760.8    765.20
```

```
K         11208DAM                                                    1
K1        RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11208
1      1        2      .16                .16        1                                  1
                24.6      100       120       130
T                                                                    -1       -93
K2                .25
K                            1
K         21120DAM                                                    1
K1        COMBINE HYDROGRAPHS
K         11120LAM                                                    1
K1        ROUTE HYDROGRAPH THROUGH DAM 11208
Y                                          1         1
Y1     1                                                          -759       -1
Y4   759      760   760.53   760.82   761.25   761.87   762.35   762.75    763.1   763.41
Y4763.69   764.21   764.90
YR     0       41      106      158      253      440      626      811     1074     1634
Y5  2799     5071     8865
YS     0      2.2      5.2     15.1     29.3     48.3     74.5     91.3      111    408.5
YE   745      749      751      753      755      757      759      760      761      770
Y1   759
YC   761
K     99
```

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*******************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
LAST MODIFICATION  26 FEB 79
*******************************

 RUN DATE= 80/08/26.
     TIME= 10.24.08.

                    DAM SAFETY INSPECTION - MISSOURI
              NOHL IRRIGATION SOUTH LAKE DAM (MO.11208)
                          FIFTY PERCENT PMF

                        JOB SPECIFICATION
      NQ     NHR    NMIN    IDAY     IHR    IMIN   METRC    IPLT    IPRT   NSTAN
     300       0       5       0       0       0       0       0       0       0
                  JOPER     NVW   LROPT   TRACE
                      5       0       0       0

              MULTI-PLAN ANALYSES TO BE PERFORMED
                  NPLAN= 1 NRTIO= 1 LRTIO= 1
          RTIO=    .50

**********  **********  **********  **********  **********

                    SUB-AREA RUNOFF COMPUTATION

          RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11208

          ISTAQ   ICOMP   IECON   ITAPE   JPLT   JPRT  INAME  ISTAGE  IAUTO
          2690AM      0       0       0      0      0      1       0      0

                        HYDROGRAPH DATA
      IHYDG   IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO  ISNOW  ISAME  LOCAL
          1      2    .48    0.00     .48    1.00   0.000      0      1      0

                          PRECIP DATA
        SPFE    PMS     R6     R12     R24     R48     R72     R96
        0.00  24.60  100.00  120.00  130.00    0.00    0.00    0.00

                          LOSS DATA
     LROPT  STRKR  DLTKR  RTIOL  ERAIN  STRKS  RTIOK  STRTL  CNSTL  ALSMX  RTIMP
         0   0.00   0.00   1.00   0.00   0.00   1.00  -1.00 -93.00   0.00   0.00

  CURVE NO.=  -93.00  WETNESS =  -1.00  EFFECT CN =   93.00

                      UNIT HYDROGRAPH DATA
                  TC=   0.00    LAG=   .43

                        RECESSION DATA
                  STRTQ=    0.00    QRCSN=    0.00    RTIOR= 1.00

  UNIT HYDROGRAPH 28 END OF PERIOD ORDINATES, TC=    0.00 HOURS, LAG=   .43  VOL= 1.00
    91.   124.   257.   404.   478.   485.   441.   374.   279.   202.
   160.   115.    87.    65.    49.    36.    27.    20.    15.    12.
```

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.35	151	.21	.20	.00	590.
1.01	.10	2	.01	0.00	.01	0.	1.01	12.40	152	.21	.20	.00	601.
1.01	.15	3	.01	0.00	.01	0.	1.01	12.45	153	.21	.20	.00	639.
1.01	.20	4	.01	0.00	.01	0.	1.01	12.50	154	.21	.20	.00	667.
1.01	.25	5	.01	0.00	.01	0.	1.01	12.55	155	.21	.20	.00	688.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.00	156	.21	.20	.00	703.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.05	157	.25	.24	.00	717.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.10	158	.25	.24	.00	731.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.15	159	.25	.24	.00	749.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.20	160	.25	.24	.00	770.
1.01	.55	11	.01	0.00	.01	0.	1.01	13.25	161	.25	.24	.00	794.
1.01	1.00	12	.01	.00	.01	0.	1.01	13.30	162	.25	.24	.00	816.
1.01	1.05	13	.01	.00	.01	0.	1.01	13.35	163	.25	.24	.00	837.
1.01	1.10	14	.01	.00	.01	0.	1.01	13.40	164	.25	.24	.00	854.
1.01	1.15	15	.01	.00	.01	0.	1.01	13.45	165	.25	.24	.00	867.
1.01	1.20	16	.01	.00	.01	1.	1.01	13.50	166	.25	.24	.00	876.
1.01	1.25	17	.01	.00	.01	2.	1.01	13.55	167	.25	.24	.00	883.
1.01	1.30	18	.01	.00	.01	3.	1.01	14.00	168	.25	.24	.00	889.
1.01	1.35	19	.01	.00	.01	4.	1.01	14.05	169	.31	.31	.00	895.
1.01	1.40	20	.01	.00	.01	5.	1.01	14.10	170	.31	.31	.00	906.
1.01	1.45	21	.01	.00	.01	6.	1.01	14.15	171	.31	.31	.00	924.
1.01	1.50	22	.01	.00	.01	7.	1.01	14.20	172	.31	.31	.00	950.
1.01	1.55	23	.01	.00	.01	8.	1.01	14.25	173	.31	.31	.00	981.
1.01	2.00	24	.01	.00	.01	10.	1.01	14.30	174	.31	.31	.00	1012.
1.01	2.05	25	.01	.00	.01	11.	1.01	14.35	175	.31	.31	.00	1040.
1.01	2.10	26	.01	.01	.01	12.	1.01	14.40	176	.31	.31	.00	1063.
1.01	2.15	27	.01	.01	.01	13.	1.01	14.45	177	.31	.31	.00	1081.
1.01	2.20	28	.01	.01	.01	14.	1.01	14.50	178	.31	.31	.00	1094.
1.01	2.25	29	.01	.01	.01	15.	1.01	14.55	179	.31	.31	.00	1103.
1.01	2.30	30	.01	.01	.01	16.	1.01	15.00	180	.31	.31	.00	1111.
1.01	2.35	31	.01	.01	.01	17.	1.01	15.05	181	.19	.19	.00	1111.
1.01	2.40	32	.01	.01	.01	18.	1.01	15.10	182	.37	.37	.00	1108.
1.01	2.45	33	.01	.01	.01	19.	1.01	15.15	183	.37	.37	.00	1104.
1.01	2.50	34	.01	.01	.01	20.	1.01	15.20	184	.56	.56	.00	1113.
1.01	2.55	35	.01	.01	.01	21.	1.01	15.25	185	.65	.65	.00	1159.
1.01	3.00	36	.01	.01	.01	22.	1.01	15.30	186	1.59	1.59	.00	1289.
1.01	3.05	37	.01	.01	.01	22.	1.01	15.35	187	2.62	2.61	.00	1585.
1.01	3.10	38	.01	.01	.01	23.	1.01	15.40	188	1.03	1.03	.00	2053.
1.01	3.15	39	.01	.01	.01	24.	1.01	15.45	189	.65	.65	.00	2654.
1.01	3.20	40	.01	.01	.01	25.	1.01	15.50	190	.56	.56	.00	3213.
1.01	3.25	41	.01	.01	.01	25.	1.01	15.55	191	.37	.37	.00	3532.
1.01	3.30	42	.01	.01	.01	26.	1.01	16.00	192	.37	.37	.00	3587.
1.01	3.35	43	.01	.01	.01	27.	1.01	16.05	193	.29	.29	.00	3427.
1.01	3.40	44	.01	.01	.01	27.	1.01	16.10	194	.29	.29	.00	3115.
1.01	3.45	45	.01	.01	.01	28.	1.01	16.15	195	.29	.29	.00	2716.
1.01	3.50	46	.01	.01	.01	28.	1.01	16.20	196	.29	.29	.00	2346.
1.01	3.55	47	.01	.01	.01	29.	1.01	16.25	197	.29	.29	.00	2049.
1.01	4.00	48	.01	.01	.00	29.	1.01	16.30	198	.29	.29	.00	1814.
1.01	4.05	49	.01	.01	.00	30.	1.01	16.35	199	.29	.29	.00	1628.
1.01	4.10	50	.01	.01	.00	30.	1.01	16.40	200	.29	.29	.00	1485.
1.01	4.15	51	.01	.01	.00	31.	1.01	16.45	201	.29	.29	.00	1378.
1.01	4.20	52	.01	.01	.00	31.	1.01	16.50	202	.29	.29	.00	1297.
1.01	4.25	53	.01	.01	.00	32.	1.01	16.55	203	.29	.29	.00	1237.
1.01	4.30	54	.01	.01	.00	32.	1.01	17.00	204	.29	.29	.00	1193.
1.01	4.35	55	.01	.01	.00	32.	1.01	17.05	205	.23	.23	.00	1157.

1.01	4.40	56	.01	.01	.00	33.	1.01	17.10	206	.23	.23	.00	1124.	
1.01	4.45	57	.01	.01	.00	33.	1.01	17.15	207	.23	.23	.00	1090.	
1.01	4.50	58	.01	.01	.00	33.	1.01	17.20	208	.23	.23	.00	1057.	
1.01	4.55	59	.01	.01	.00	34.	1.01	17.25	209	.23	.23	.00	1011.	
1.01	5.00	60	.01	.01	.00	34.	1.01	17.30	210	.23	.23	.00	974.	
1.01	5.05	61	.01	.01	.00	35.	1.01	17.35	211	.23	.23	.00	940.	
1.01	5.10	62	.01	.01	.00	36.	1.01	17.40	212	.23	.23	.00	911.	
1.01	5.15	63	.01	.01	.00	35.	1.01	17.45	213	.23	.23	.00	889.	
1.01	5.20	64	.01	.01	.00	36.	1.01	17.50	214	.23	.23	.00	875.	
1.01	5.25	65	.01	.01	.00	36.	1.01	17.55	215	.23	.23	.00	862.	
1.01	5.30	66	.01	.01	.00	36.	1.01	18.00	216	.23	.23	.00	854.	
1.01	5.35	67	.01	.01	.00	36.	1.01	18.05	217	.02	.02	.00	840.	
1.01	5.40	68	.01	.01	.00	37.	1.01	18.10	218	.02	.02	.00	810.	
1.01	5.45	69	.01	.01	.00	37.	1.01	18.15	219	.02	.02	.00	754.	
1.01	5.50	70	.01	.01	.00	37.	1.01	18.20	220	.02	.02	.00	669.	
1.01	5.55	71	.01	.01	.00	37.	1.01	18.25	221	.02	.02	.00	570.	
1.01	6.00	72	.01	.01	.00	38.	1.01	18.30	222	.02	.02	.00	469.	
1.01	6.05	73	.07	.05	.01	40.	1.01	18.35	223	.02	.02	.00	370.	
1.01	6.10	74	.07	.05	.01	45.	1.01	18.40	224	.02	.02	.00	300.	
1.01	6.15	75	.07	.06	.01	57.	1.01	18.45	225	.02	.02	.00	242.	
1.01	6.20	76	.07	.06	.01	75.	1.01	18.50	226	.02	.02	.00	201.	
1.01	6.25	77	.07	.06	.01	96.	1.01	18.55	227	.02	.02	.00	170.	
1.01	6.30	78	.07	.06	.01	119.	1.01	19.00	228	.02	.02	.00	146.	
1.01	6.35	79	.07	.06	.01	139.	1.01	19.05	229	.02	.02	.00	128.	
1.01	6.40	80	.07	.06	.01	158.	1.01	19.10	230	.02	.02	.00	114.	
1.01	6.45	81	.07	.06	.01	172.	1.01	19.15	231	.02	.02	.00	104.	
1.01	6.50	82	.07	.06	.01	183.	1.01	19.20	232	.02	.02	.00	97.	
1.01	6.55	83	.07	.06	.01	192.	1.01	19.25	233	.02	.02	.00	92.	
1.01	7.00	84	.07	.06	.01	199.	1.01	19.30	234	.02	.02	.00	87.	
1.01	7.05	85	.07	.06	.01	205.	1.01	19.35	235	.02	.02	.00	84.	
1.01	7.10	86	.07	.06	.01	210.	1.01	19.40	236	.02	.02	.00	82.	
1.01	7.15	87	.07	.06	.01	214.	1.01	19.45	237	.02	.02	.00	80.	
1.01	7.20	88	.07	.06	.01	218.	1.01	19.50	238	.02	.02	.00	79.	
1.01	7.25	89	.07	.06	.01	221.	1.01	19.55	239	.02	.02	.00	78.	
1.01	7.30	90	.07	.06	.01	223.	1.01	20.00	240	.02	.02	.00	77.	
1.01	7.35	91	.07	.06	.00	225.	1.01	20.05	241	.02	.02	.00	76.	
1.01	7.40	92	.07	.06	.00	227.	1.01	20.10	242	.02	.02	.00	76.	
1.01	7.45	93	.07	.06	.00	229.	1.01	20.15	243	.02	.02	.00	76.	
1.01	7.50	94	.07	.06	.00	230.	1.01	20.20	244	.02	.02	.00	76.	
1.01	7.55	95	.07	.06	.00	231.	1.01	20.25	245	.02	.02	.00	76.	
1.01	8.00	96	.07	.06	.00	233.	1.01	20.30	246	.02	.02	.00	76.	
1.01	8.05	97	.07	.06	.00	234.	1.01	20.35	247	.02	.02	.00	76.	
1.01	8.10	98	.07	.06	.00	235.	1.01	20.40	248	.02	.02	.00	76.	
1.01	8.15	99	.07	.06	.00	236.	1.01	20.45	249	.02	.02	.00	76.	
1.01	8.20	100	.07	.07	.00	236.	1.01	20.50	250	.02	.02	.00	76.	
1.01	8.25	101	.07	.07	.00	237.	1.01	20.55	251	.02	.02	.00	76.	
1.01	8.30	102	.07	.07	.00	238.	1.01	21.00	252	.02	.02	.00	76.	
1.01	8.35	103	.07	.07	.00	238.	1.01	21.05	253	.02	.02	.00	76.	
1.01	8.40	104	.07	.07	.00	239.	1.01	21.10	254	.02	.02	.00	76.	
1.01	8.45	105	.07	.07	.00	239.	1.01	21.15	255	.02	.02	.00	76.	
1.01	8.50	106	.07	.07	.00	240.	1.01	21.20	256	.02	.02	.00	76.	
1.01	8.55	107	.07	.07	.00	240.	1.01	21.25	257	.02	.02	.00	76.	
1.01	9.00	108	.07	.07	.00	241.	1.01	21.30	258	.02	.02	.00	76.	
1.01	9.05	109	.07	.07	.00	241.	1.01	21.35	259	.02	.02	.00	76.	
1.01	9.10	110	.07	.07	.00	242.	1.01	21.40	260	.02	.02	.00	76.	
1.01	9.15	111	.07	.07	.00	242.	1.01	21.45	261	.02	.02	.00	76.	
1.01	9.20	112	.07	.07	.00	243.	1.01	21.50	262	.02	.02	.00	76.	
1.01	9.25	113	.07	.07	.00	243.	1.01	21.55	263	.02	.02	.00	76.	
1.01	9.30	114	.07	.07	.00	243.	1.01	22.00	264	.02	.02	.00	76.	
1.01	9.35	115	.07	.07	.00	244.	1.01	22.05	265	.02	.02	.00	76.	

1.01	9.00	116	.07	.07	.00	240.	1.01	22.10	266	.02	.02	.00	76.
1.01	9.05	117	.07	.07	.00	240.	1.01	22.15	267	.02	.02	.00	76.
1.01	9.10	118	.07	.07	.00	240.	1.01	22.20	268	.02	.02	.00	76.
1.01	9.15	119	.07	.07	.00	240.	1.01	22.25	269	.02	.02	.00	76.
1.01	10.00	120	.07	.07	.00	245.	1.01	22.30	270	.02	.02	.00	76.
1.01	10.05	121	.07	.07	.00	245.	1.01	22.35	271	.02	.02	.00	76.
1.01	10.10	122	.07	.07	.00	245.	1.01	22.40	272	.02	.02	.00	76.
1.01	10.15	123	.07	.07	.00	245.	1.01	22.45	273	.02	.02	.00	76.
1.01	10.20	124	.07	.07	.00	246.	1.01	22.50	274	.02	.02	.00	76.
1.01	10.25	125	.07	.07	.00	246.	1.01	22.55	275	.02	.02	.00	76.
1.01	10.30	126	.07	.07	.00	246.	1.01	23.00	276	.02	.02	.00	76.
1.01	10.35	127	.07	.07	.00	246.	1.01	23.05	277	.02	.02	.00	76.
1.01	10.40	128	.07	.07	.00	246.	1.01	23.10	278	.02	.02	.00	76.
1.01	10.45	129	.07	.07	.00	247.	1.01	23.15	279	.02	.02	.00	76.
1.01	10.50	130	.07	.07	.00	247.	1.01	23.20	280	.02	.02	.00	76.
1.01	10.55	131	.07	.07	.00	247.	1.01	23.25	281	.02	.02	.00	76.
1.01	11.00	132	.07	.07	.00	247.	1.01	23.30	282	.02	.02	.00	76.
1.01	11.05	133	.07	.07	.00	247.	1.01	23.35	283	.02	.02	.00	76.
1.01	11.10	134	.07	.07	.00	247.	1.01	23.40	284	.02	.02	.00	76.
1.01	11.15	135	.07	.07	.00	247.	1.01	23.45	285	.02	.02	.00	76.
1.01	11.20	136	.07	.07	.00	248.	1.01	23.50	286	.02	.02	.00	76.
1.01	11.25	137	.07	.07	.00	248.	1.01	23.55	287	.02	.02	.00	76.
1.01	11.30	138	.07	.07	.00	248.	1.02	0.00	288	.02	.02	.00	76.
1.01	11.35	139	.07	.07	.00	248.	1.02	.05	289	0.00	0.00	0.00	75.
1.01	11.40	140	.07	.07	.00	248.	1.02	.10	290	0.00	0.00	0.00	72.
1.01	11.45	141	.07	.07	.00	248.	1.02	.15	291	0.00	0.00	0.00	67.
1.01	11.50	142	.07	.07	.00	248.	1.02	.20	292	0.00	0.00	0.00	59.
1.01	11.55	143	.07	.07	.00	248.	1.02	.25	293	0.00	0.00	0.00	49.
1.01	12.00	144	.07	.07	.00	248.	1.02	.30	294	0.00	0.00	0.00	39.
1.01	12.05	145	.21	.20	.00	254.	1.02	.35	295	0.00	0.00	0.00	30.
1.01	12.10	146	.21	.20	.00	271.	1.02	.40	296	0.00	0.00	0.00	22.
1.01	12.15	147	.21	.20	.00	306.	1.02	.45	297	0.00	0.00	0.00	17.
1.01	12.20	148	.21	.20	.00	360.	1.02	.50	298	0.00	0.00	0.00	12.
1.01	12.25	149	.21	.20	.00	425.	1.02	.55	299	0.00	0.00	0.00	9.
1.01	12.30	150	.21	.20	.00	491.	1.02	1.00	300	0.00	0.00	0.00	7.
									SUM	31.98	31.09	.69	114799.
										(812.)(	790.)(	23.)(	3250.75)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3587.	1254.	399.	383.	114776.
CMS	102.	35.	11.	11.	3250.
INCHES		24.06	31.09	31.09	31.09
MM		611.21	789.63	789.63	789.63
AC-FT		612.	790.	790.	790.
THOUS CU M		755.	975.	975.	975.

HYDROGRAPH AT STA209DAM FOR PLAN 1, RIIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	
0.	0.	0.	0.	0.	0.	1.	1.	2.	2.	
3.	4.	4.	5.	5.	6.	7.	7.	8.	8.	
9.	9.	10.	10.	10.	11.	11.	12.	12.	12.	
13.	13.	13.	14.	14.	14.	14.	15.	15.	15.	
15.	16.	16.	16.	16.	16.	17.	17.	17.	17.	
17.	17.	18.	18.	18.	18.	18.	18.	18.	19.	
19.	19.	20.	25.	28.	37.	48.	59.	70.	79.	
86.	92.	96.	100.	103.	105.	107.	109.	110.	111.	
113.	114.	114.	115.	116.	116.	117.	117.	118.	118.	

119.	119.	119.	119.	120.	120.	120.	120.	121.	121.	
121.	121.	121.	122.	122.	122.	122.	122.	122.	122.	
123.	123.	123.	123.	123.	123.	123.	123.	123.	183.	
123.	123.	124.	124.	124.	124.	124.	124.	124.	129.	
124.	124.	124.	184.	227.	186.	183.	180.	212.	245.	
278.	301.	320.	333.	344.	352.	359.	366.	374.	385.	
397.	408.	418.	427.	435.	438.	448.	444.	448.	459.	
468.	475.	491.	506.	520.	532.	540.	547.	552.	555.	
556.	558.	552.	544.	580.	648.	798.	1026.	1321.	1607.	
1794.	1794.	1713.	1558.	1358.	1173.	1024.	907.	814.	748.	
689.	649.	618.	596.	578.	562.	549.	535.	506.	487.	
470.	456.	445.	436.	421.	407.	420.	405.	377.	335.	
285.	230.	189.	160.	121.	100.	85.	73.	64.	57.	
52.	48.	46.	44.	42.	41.	40.	39.	39.	38.	
38.	38.	38.	38.	38.	38.	38.	38.	38.	38.	
38.	38.	38.	38.	38.	38.	38.	38.	38.	38.	
38.	38.	38.	38.	38.	38.	38.	38.	38.	38.	
38.	38.	38.	38.	38.	38.	38.	38.	38.	38.	
38.	38.	38.	38.	38.	38.	38.	38.	37.	36.	
36.	29.	24.	19.	15.	11.	8.	6.	5.	3.	

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	1794.	617.	199.	141.	57366.
CMS	51.	17.	6.	4.	1625.
INCHES		12.08	15.54	15.54	15.54
MM		305.60	394.82	394.82	894.82
AC-FT		3814.	3955.	3955.	3955.
THOUS CU M		577.	488.	488.	488.

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH DAM 11209

ISTAG	ICOMP	IECON	ITAPE	JTIFT	JPNT	INAME	ISTAGE	IAUTO
209DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTOL	LAG	AMSKK	X	ISK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-761.	-1

STAGE	760.84	761.84	762.28	763.09	764.79	764.94	765.09	765.39	765.84	766.59
	767.34	767.89								
FLOW	0.00	25.00	76.00	241.00	499.00	647.00	913.00	1634.00	3075.00	6195.00
	10067.00	19543.00								
CAPACITY=	0.	0.	1.	3.	7.	14.	26.	27.	50.	299.
ELEVATION=	769.	781.	753.	756.	787.	789.	761.	761.	763.	770.

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH DAM 11208

	ISTAO	ICOMP	ICON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	208DAM	1	0	0	0	0	1	0	0

ROUTING DATA

	QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
	0.0	0.000	0.00	1	1	0	0	0

	NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	IPRAT
	1	0	0	0.000	0.000	0.000	-759.	-1

STAGE	759.00	760.00	760.53	760.82	761.25	761.87	762.15	762.79	763.10	763.41
	763.63	764.21	764.90							
FLOW	0.00	91.00	106.00	1NN.00	253.00	440.00	626.00	811.00	1074.00	1834.00
	2799.00	5071.00	8865.00							
CAPACITY=	0.	2.	6.	15.	29.	48.	75.	91.	111.	409.
ELEVATION=	745.	749.	751.	753.	755.	757.	759.	760.	761.	770.

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
759.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
761.0	0.0	0.0	0.

STATION 208DAM, PLAN 1, RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

PO.DA	HR.MN	PERIOD	HOURS	INFLOW	OUTFLOW	STORAGE	STAGE
1.01	.05	1	.08	0.	0.	75.	759.0
1.01	.10	2	.17	0.	0.	75.	759.0
1.01	.15	3	.25	0.	0.	75.	759.0
1.01	.20	4	.33	0.	0.	75.	759.0
1.01	.25	5	.42	0.	0.	75.	759.0
1.01	.30	6	.50	0.	0.	75.	759.0
1.01	.35	7	.58	0.	0.	75.	759.0
1.01	.40	8	.67	0.	0.	75.	759.0
1.01	.45	9	.75	0.	0.	75.	759.0
1.01	.50	10	.83	0.	0.	75.	759.0
1.01	.55	11	.92	0.	0.	75.	759.0
1.01	1.00	12	1.00	0.	0.	75.	759.0
1.01	1.05	13	1.08	0.	0.	75.	759.0
1.01	1.10	14	1.17	0.	0.	75.	759.0
1.01	1.15	15	1.25	0.	0.	75.	759.0
1.01	1.20	16	1.33	0.	0.	75.	759.0
1.01	1.25	17	1.42	1.	0.	75.	759.0
1.01	1.30	18	1.50	1.	0.	75.	759.0
1.01	1.35	19	1.58	1.	0.	75.	759.0

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .50
				RATIOS APPLIED TO FLOWS
HYDROGRAPH AT	209DAM	.48	1	1794.
		(1.24)		(50.79)
ROUTED TO	209DAM	.48	1	1576.
		(1.24)		(44.63)
HYDROGRAPH AT	208DAM	.16	1	770.
		(.41)		(21.80)
2 COMBINED	208DAM	.64	1	1933.
		(1.65)		(54.73)
ROUTED TO	208DAM	.64	1	1518.
		(1.65)		(42.98)

B-34

U/S DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	760.80	760.80	762.80
STORAGE	26.	26.	50.
OUTFLOW	0.	0.	148.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	765.38	2.58	134.	1578.	6.67	16.10	16.00

B-35

KOHL IRRIGATION LAKE SOUTH DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	749.00	759.00	761.00
STORAGE	79.	79.	111.
OUTFLOW	0.	0.	198.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.80	748.28	8.28	196.	1518.	9.00	16.42	0.00

FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79

RUN DATE= 80/08/26.
TIME= 10.01.18.

DAM SAFETY INSPECTION - MISSOURI
KOHL IRRIGATION SOUTH LAKE DAM (NO.11208)
PERCENT PMF

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	ITRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIOS 5 LRTIO= 1

RTIOS= .05 .06 .07 .08 .09

SUB-AREA RUNOFF COMPUTATION

RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11208

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
208DAM	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.49	0.00	.49	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.60	100.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-93.00	0.00	0.00

CURVE NO = -93.00 WETNESS = -1.00 EFFECT CN = 93.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .43

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH DAM 11209

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
209DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	3

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-761.	-1

ELEV	760.00	761.00	762.00	763.00	764.00	764.50	765.00	763.50	765.00	766.00
	767.50	767.00								
FLOW	0.00	25.00	79.00	241.00	409.00	647.00	910.00	1634.00	3075.00	6196.00
	10097.00	14543.00								
CAPACITY=	0.	0.	1.	5.	7.	14.	26.	27.	50.	294.
ELEVATION=	749.	751.	753.	755.	757.	759.	761.	761.	763.	770.

CPEL	SPWID	COOW	EXPW	ELEVI	COOL	CAREA	EXPL
760.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
762.8	0.0	0.0	0.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
10.	.50	759.00	1.00	760.80	762.80

PEAK OUTFLOW IS 71. AT TIME 16.75 HOURS

PEAK OUTFLOW IS 99. AT TIME 16.67 HOURS

PEAK OUTFLOW IS 117. AT TIME 16.58 HOURS

PEAK OUTFLOW IS 139. AT TIME 16.50 HOURS

BEGIN DAM FAILURE AT 16.25 HOURS

PEAK OUTFLOW IS 299. AT TIME 17.25 HOURS

AD-A104 975 PRC CONSOER TOWNSEND INC ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. KOHL IRRIGATION LAKE SOUTH DAM (MO--ETC(U)
DEC 80 W G SHIFRIN DACW43-80-C-0094
UNCLASSIFIED NL

SUBAREA RUNOFF COMPUTATION

RUNOFF CALCULATIONS FOR DRAINAGE AREA OF DAM 11208

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
208DAM	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	.14	0.00	.14	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.60	100.00	100.00	100.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOR	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-33.00	0.00	0.00

CURVE NO = -98.00 WETNESS = -1.00 EFFECT CN = 98.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .25

RECESSION DATA

STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 31.98 31.09 .89 38489.
(812.14 790.31 23.31 1869.89)

COMBINE HYDROGRAPHS

COMBINE HYDROGRAPHS

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
208DAM	2	0	0	0	0	1	0	0

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH DAM 11208

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
208DAM	1	0	0	0	0	1	0	0

ROUTING DATA

	QLOSS	CLOSS	AMSK	ITYPE	ISAME	ICOMP	IPMP	LSTA
	0.0	0.000	0.00	1	1	0	0	0

	NSTPS	NSTOL	LAG	AMSKK	X	TSK	STORA	ISPRAT
	1	0	0	0.000	0.000	0.000	-789.	-1

STAGE	759.83	760.00	760.83	760.82	761.85	761.87	762.85	762.79	763.38	763.93
	764.49	765.03	765.70							
FLOW	0.00	41.00	106.00	158.00	253.00	440.00	626.00	811.00	1074.00	1354.00
	2739.00	8071.00	8869.00							
CAPACITY=	0.	8.	6.	15.	29.	48.	75.	91.	111.	400.
ELEVATION=	745.	749.	751.	753.	755.	757.	759.	760.	761.	770.

	CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
	769.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
761.0	0.0	0.0	0.

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	MSEL	FAILEL
10.	.50	759.00	1.00	760.83	764.80

PEAK OUTFLOW IS 154. AT TIME 0.00 HOURS

PEAK OUTFLOW IS 154. AT TIME 0.00 HOURS

PEAK OUTFLOW IS 154. AT TIME 0.00 HOURS

PEAK OUTFLOW IS 154. AT TIME 0.00 HOURS

PEAK OUTFLOW IS 219. AT TIME 17.83 HOURS

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO APPLIED TO FLOWS				
				RATIO 1 .05	RATIO 2 .06	RATIO 3 .07	RATIO 4 .08	RATIO 5 .09
HYDROGRAPH AT	209DAM	.48 (1.24)	1	179. (5.07)	219. (6.20)	261. (7.39)	287. (8.13)	323. (9.14)
ROUTED TO	209DAM	.48 (1.24)	1	71. (2.01)	93. (2.63)	117. (3.31)	139. (3.93)	298. (8.43)
HYDROGRAPH AT	208DAM	.15 (.39)	1	77. (2.18)	92. (2.62)	108. (3.05)	123. (3.49)	139. (3.92)
2 COMBINED	208DAM	.64 (1.65)	1	120. (3.39)	147. (4.16)	173. (4.91)	200. (5.66)	3.7. (9.27)
ROUTED TO	208DAM	.64 (1.65)	1	145. (4.11)	145. (4.11)	145. (4.11)	145. (4.11)	214. (6.06)

U/S DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	760.00	760.00	762.00
STORAGE	26.	26.	30.
OUTFLOW	0.	0.	149.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	762.17	0.00	32.	71.	0.00	16.75	0.00
.06	762.36	0.00	44.	93.	0.00	16.67	0.00
.07	762.57	0.00	47.	117.	0.00	16.58	0.00
.08	762.75	0.00	49.	134.	0.00	16.50	0.00
.09	762.85	.05	51.	298.	.60	17.25	16.25

B-42

KOHL IRRIGATION LAKE SOUTH DAM

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	760.00	759.00	761.00
STORAGE	107.	75.	111.
OUTFLOW	154.	0.	198.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	760.75	0.00	107.	154.	0.00	0.00	0.00
.06	760.75	0.00	107.	154.	0.00	0.00	0.00
.07	760.75	0.00	107.	154.	0.00	0.00	0.00
.08	760.75	0.00	107.	154.	0.00	0.00	0.00
.09	761.07	.07	113.	214.	1.33	17.83	0.00

B-43